FLORA OF BHUTAN

INCLUDING A RECORD OF PLANTS FROM
SIKKIM AND DARJEELING

VOLUME 3 PART 3

The Orchids of Bhutan

N. R. PEARCE & P. J. CRIBB

ILLUSTRATED BY SUSANNA STUART-SMITH

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2002

Dedicated to the memory of Dr Jany Renz (1907–1999) who undertook the preliminary work on the tribe Orchideae, but sadly did not live to complete it.

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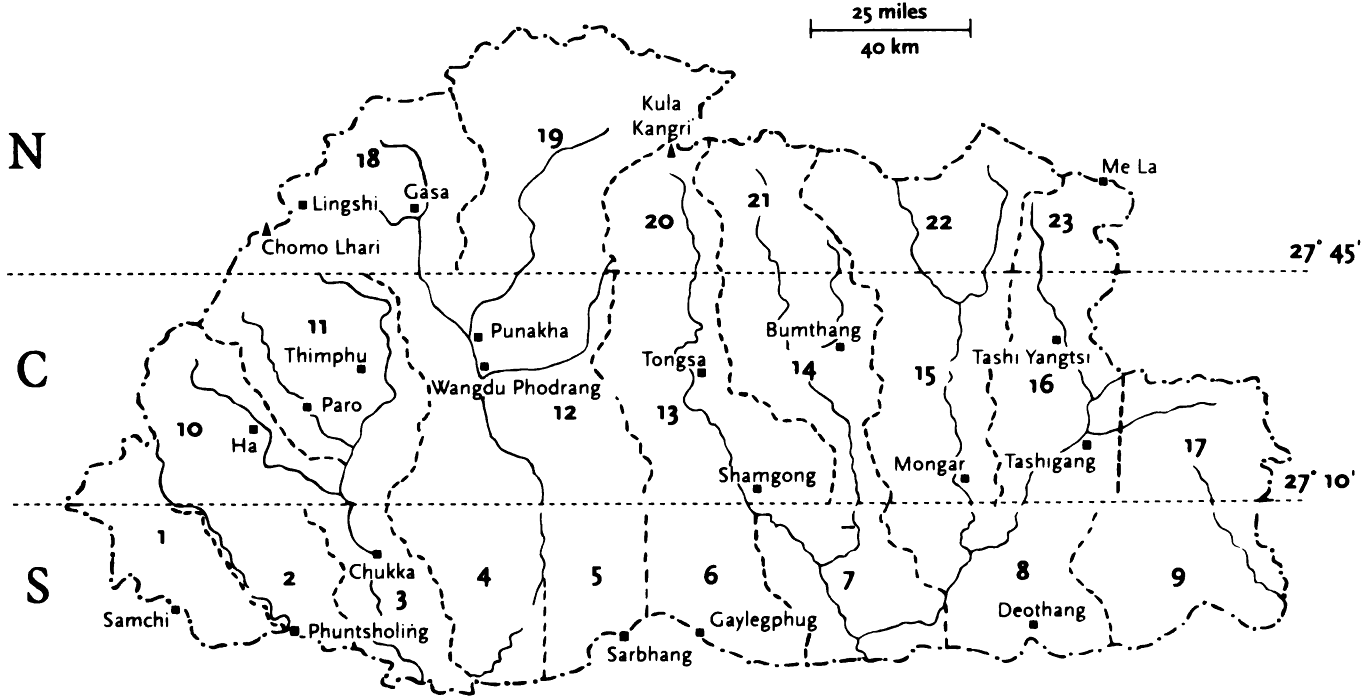

Map of Bhutan showing botanical districts:
South (S): 1, Samchi; 2, Phuntsholing; 3, Chukka; 4, Sankosh; 5, Sarbhang; 6, Gaylegphug; 7, Manas, 8, Deothang, 9, Dhansiri
Central (C); 10, Ha, 11, Thimphu, 12, Punakha; 13, Tongsa; 14, Bumthang; 15, Mongar; 16, Tashigang; 17, Sakden
North (N): 18, Upper Mo Chu; 19, Upper Pho Chu; 20, Upper Mangde Chu; 21, Upper Bumthang Chu, 22, Upper Kuru Chu, 23, Upper Kulong Chu

Drawn by Abi Lezemore/Sally Rae

FOREWORD

This book marks the end of a major Flora project which has taken a little over a quarter of a century to complete. It is therefore particularly pleasing that it should be concluded with such a magnificent volume as the present one, devoted to the largest and arguably the most spectacular of all the plant families occurring in Bhutan and Sikkim.

As will be immediately apparent the format is more lavish in every way than earlier parts of the *Flora*, for which there are several reasons. The initial aim of the *Flora* was to make a work that was easy to use in the field and portable, however, with 579 species of orchid confirmed for the area, this was always going to be a substantial volume. With constraints imposed by portability gone, it was thought worthwhile to include additional material not given in earlier volumes (such as distributions outwith the *Flora* area, more thorough synonymy, etymology of scientific names, citation of types and a listing of all specimens examined). All of this additional information will be of great use to those interested in orchid taxonomy not only in Bhutan but also in surrounding countries such as India, Nepal and China.

Whereas the other volumes of the *Flora* have all been written at Edinburgh, this one has been written at our sister organisation, the Royal Botanic Gardens, Kew. I am personally hugely indebted to the people who have made this collaboration possible and would like to record this. Firstly I must express my gratitude to the senior author, Dr Nicholas Pearce who, incredible though it may seem, has written the book largely in his 'spare time', taken from a full time job as a busy General Practitioner. Secondly I would like to thank Dr Phillip Cribb who encouraged Nick to undertake the work in the first place and who has been a constant source of advice throughout the project. This collaboration culminated in the joint field trip made by the authors in May and June 2000.

A project of this magnitude and complexity has not been without its challenges and difficulties but the task is now complete and the Royal Botanic Garden Edinburgh is extremely proud to have been able to accomplish this primary documentation of Bhutan's outstanding flora. The initial aim of the project was to publish information about collections of Bhutanese plants in British herbaria accumulated over the period since William Griffith's pioneering expedition of 1838. This has now been achieved, in fulfilment of our undertaking to the Royal Government of Bhutan. The *Flora* was initiated in 1974 and until 1988 the groundwork for the project and the taxonomic research for a substantial part of the dicots was undertaken entirely by the late Andrew J.C. Grierson and David G. Long; thereafter the work became more of a team effort. In addition to continued support from the Royal Botanic Garden Edinburgh and its sponsoring bodies (currently Scottish Executive Rural Affairs Department), major financial support for the project came initially from the British Government's Overseas Development Administration. Since 1998 additional support has come from DANIDA, the Overseas Aid division of the Royal Danish Ministry of Foreign Affairs.

The work could not have been done without the support of the Royal Government of Bhutan, especially through its Ministry of Agriculture (including the Forest Department). Their role has been especially important in allowing, and supporting, a series of six field expeditions undertaken between 1975 and 2000 by Andrew Grierson, David Long, Iain Sinclair, myself, Nick Pearce and Phillip Cribb. This fieldwork has allowed a much more complete treatment of the flora than would have been possible had only historical collections been used.

Primary documentation of the flora, however, is only the first stage in acquiring a broader and more detailed knowledge of Bhutan's plantlife, and there is still much work to be done. Important topics will include ecology, conservation and pollination biology, all of which will be best studied by scientists within Bhutan. This will involve the targetting of geographical and taxonomic gaps, and moving on to more applied areas of study which can only be done within the context of a relatively secure taxonomic framework. The training of Bhutanese nationals in these fields, and the building of a new National Herbarium, are vital steps in this process and it gives me great pleasure to see these ongoing developments.

H.J. Noltie

INTRODUCTION

The orchids of Bhutan – a biogeographical assessment

Orchidaceae is the largest family of flowering plants in the area, representing slightly more than 10% of the total flora. In terms of habitats in which they occur, orchids are almost ubiquitous, being found in all the vegetation zones recognised by Grierson and Long (1983).

The total number of species, based on verified specimens from the Flora area (Bhutan, Sikkim, Darjeeling and the Chumbi Valley), has been found to be no less than 579 (table 1) of which over half are epiphytes, the remainder being terrestrial in habit. Of these some 369 have been recorded for Bhutan and an additional 210 are known so far only from Sikkim and/or Darjeeling. The majority of the latter are likely to be discovered in Bhutan sooner or later. A further 86 species have been reported in the literature from the Sikkim and Darjeeling area, but are doubtful since no voucher material of them has been seen. An additional 44 species have been reliably reported from the W Kameng district of Arunachal Pradesh, immediately to the east of Bhutan, and no doubt at least some of these will eventually be found in Bhutan.

Fourteen species are considered to be endemic to Bhutan; of these six are epiphytes and eight terrestrial (Table 2). It is possible that with further exploration some of these (many of which are known only from single collections) will be found to be more widespread. Similarly, it is likely that some, or most, of the 20 species presently considered to be endemic to Sikkim and Darjeeling will be found in

Table 1. Number of orchid species confirmed for the Flora area.

Bhutan	Sikkim/Darjeeling only	Total
369	210	579

Table 2. Endemic orchids of Bhutan. Vegetation zones after Grierson & Long (1983).

Species	Habit	Zone	Altitude (m)
Bhutanthera albosanguinea	Terrestrial	xi	4100
Bhutanthera albovirens	Terrestrial	xi	4270–4720
Bhutanthera himalaica	Terrestrial	xi	3960–4570
Bulbophyllum leopardinum var. *tuberculatum*	Epiphytic	ii	1800
Cheirostylis sherriffii	Terrestrial	iii	1200–1700
Epigenium navicularis	Epiphytic	ii	1720
Eulophia stenopetala	Terrestrial	iii	1800
Goodyera alveolatus	Terrestrial	ii	—
Herminium pygmaeum	Terrestrial	xi	3960
Hetaeria pelota	Terrestrial	vi	2330
Papilionanthe greenii	Epiphytic	ii	—
Pomatocalpa bhutanicum	Epiphytic	ii	—
Vanda bicolor	Epiphytic	ii	1000–1500
Vanda chlorosantha	Epiphytic	ii	1000–1500

Bhutan. Given this, it is more useful to give the percentage of endemism for the Flora area as a whole, which amounts to 5.8% of the total orchid flora.

As stated above, orchids have been reported from all of the vegetation types listed by Grierson and Long (1983). However, information about their habitat preferences, which has largely been taken from herbarium specimens or from the literature, is sparse, uneven in quality, and frequently lacking altogether. Such information as does exist is often difficult to match with Grierson & Long's zones. Nevertheless, it is apparent that orchid distribution is far from uniform (Table 3). On a field excursion to Bhutan in May and June 2000, we were able to supplement information obtained from herbarium specimens and literature with field observations, and this forms the basis of the following notes. Clearly this work must be extended as a matter of high priority.

The subtropical lowland forests are not especially rich in species but the orchids which occur there can often be prominent. The showy fox-tail orchids *Rhynchostylis retusa* and *Aerides multiflorum* can form massed displays on trees in the lowlands, even when the forest has been cleared. Trees along rivers can also bear an abundance of epiphytes, such as *Papilionanthe teres* and *Dendrobium moschatum*, two of the showiest of Bhutanese orchids. The hard-leaved *Cymbidium* species, *C. aloifolium* and *C. bicolor*, can also form large clumps on trees, especially near rivers.

The lower montane evergreen forests, which in places penetrate far into the Himalayas along the valleys of the larger rivers, are rich in epiphytic species, whilst terrestrials are uncommon in this habitat. The showiest orchids here include dendrobiums such as *D. densiflorum*, *D. fimbriatum* and *D. gibsonii*. However, bulbophyllums and *Pholidota articulata* are also often abundant here. The large terrestrial orchids *Phaius flavus* and *P. mishmensis* and evergreen calanthes, such as *C. tricarinata* and *C. masuca*, are typical forest floor species. In wet places the spectacular saprophytic *Galeola lindleyana* will flourish, producing reddish stems of up to 2.5m bearing very short branches of yellow flowers from large, fleshy, underground tuber-like rhizomes.

In the drier valleys between about 1000 and 2000m, some of the epiphytic orchids are adapted to survive long periods of drought. Many of these, such as *Vanda testacea* and *V. cristata*, have coriaceous leaves, while in *Luisia zeylanica* and *Cleisostoma williamsonii* their shape is also modified (cylindrical). Where moisture levels are sufficiently high, many of these species are also found growing lithophytically. *Dendrobium jenkinsii*, a small species with relatively large orange flowers, can grow quite happily on the north-facing sides of large rocks and cliffs.

Deciduous forests, dominated by Fagaceae, are amongst the richest habitats for orchids in Bhutan, especially for epiphytic species such as dendrobiums and bulbophyllums. *Quercus griffithii* is a particularly favoured 'host' for species such as *Dendrobium falconeri*, *D. nobile* and *D. devonianum*. In suitable places *Coelogyne longipes* and *C. schultesii* may form large clumps on its branches. The strange *Ceratostylis himalaica*, a representative of a predominantly Malesian genus, may also form large, pendulous clumps. Deciduous calanthes are common ground orchids in these woods, for example the brightly coloured *Calanthe tricarinata*, *C. alpina*, *C. brevicornu* and *C. mannii* are often found in large colonies in shady places on the forest floor. *Liparis cathcartii* often grows with them in suitable damp shady places.

Table 3. Orchids found in vegetation zones of Grierson & Long (1983).

Vegetation	Zones	Altitude (m)	No. of species
Lowland/riverine forest	i, ii	Under 1000	87
Lower montane forest	ii	1000–1500	147
Deciduous forest	iv, v	1500–2100	161
Pine and coniferous forest	vi–ix	2200–3500	94
Alpine grassland and scrub	x, xi	Above 3500	40

The chir pine forests dominated by *Pinus roxburghii* have very few epiphytic orchids but have a number of terrestrial species such as *Habenaria trichosantha*, *Eulophia dabia*, *E. graminea* and *E. stenopetala*. The blue pine (*Pinus wallichii*) forests are also poor in epiphytic orchids although occasionally in E Bhutan *Coelogyne raizadae* and *Eria alba* may form small clumps towards the base of their trunks. A number of terrestrial species, such as *Oreorchis micrantha* and *Cephalanthera damasonium*, are commonly found on the forest floor in blue pine forest.

Above about 2900m, subalpine forests of *Picea*, *Tsuga*, *Juniperus* and *Abies*, often with scattered trees of *Acer* and *Sorbus*, contain a relatively small number of epiphytic orchids, but these may be spectacular. *Coelogyne corymbosa* and *Pleione hookeriana* can grow in large colonies on mossy branches and tree trunks in suitable places. In this habitat, terrestrial orchids such as *Cypripedium cordigerum* and *Oreorchis foliosa* are more numerous.

Alpine grassland and scrub support a rich community of terrestrial orchids. Five slipper orchids (*Cypripedium cordigerum*, *C. elegans*, *C. guttatum*, *C. himalaicum* and *C. tibeticum*) have been recorded from Bhutan, and of these the last four favour alpine habitats. Most of the remaining terrestrial species found here belong to subfamily Orchidoideae, with genera such as *Aorchis*, *Bhutanthera*, *Chusua*, *Coeloglossum*, *Gymnadenia* and *Herminium* being frequent. Individual species can often form extensive colonies.

Geographical affinities of the orchid flora

The orchid flora of Bhutan and Sikkim is rich in numbers of both species and genera. It forms part of a wider orchid flora which encompasses the Himalayas, N Myanmar (Burma), N Thailand, N Indo-China and S China. The centre of diversity in this belt probably lies in N Myanmar (Burma) and SW China; however, in the Himalayas there is a marked increase in diversity from west to east, coinciding with an increase in rainfall and proximity to the centre of maximum diversity further east.

The largest genera in the flora are both epiphytic: *Bulbophyllum* (57 species) and *Dendrobium* (37 species). Both genera are better represented in terms of numbers of species in the Malesian region, but the Himalayan species mostly belong to sections that are characteristic of subtropical Asia. We see this in the diversity of species in section *Dendrobium*, which includes *D. nobile*, *D. falconeri*, *D. wardianum* and *D. devonianum*, and in section *Densiflora* including *D. densiflorum* and *D. jenkinsii*.

Vanda is another genus that is widely distributed throughout tropical and subtropical Asia. Our region, however, seems to be the centre of diversity of section *Cristatae* which is represented by five species, one of which, *V. chlorosantha*, is endemic to Bhutan. Other Malesian genera such as *Corybas*, *Ceratostylis* and *Paphiopedilum* are represented in our area by only one or a few species.

The large terrestrial genera include *Calanthe* (21 species), *Habenaria* (12 species) and *Eulophia* (9 species). *Calanthe* is widespread in tropical and temperate Asia with a few species extending to Australia and the Pacific, and to Madagascar, tropical and S Africa. Most of the Bhutanese species belong to the deciduous group that is most diverse in China. The evergreen species *Calanthe triplicata* is found from Madagascar across southern Asia to the Philippines, the Malay Archipelago, Australia and the SW Pacific islands; *Calanthe sylvatica* is almost equally widespread. *Eulophia* and *Habenaria* are richly represented throughout tropical and subtropical Asia as far south as Australia. However, their centres of diversity in the Old World are in tropical Africa. The saprophytic species *Eulophia zollingeri* is widely distributed, and is found as far away as NE Australia.

In contrast, several temperate Asian or Eurasian genera extend along the high Himalaya, and reach Bhutan. These include *Cephalanthera*, *Coeloglossum*, *Cypripedium*, *Herminium*, *Platanthera* and *Tipularia*. The most remarkable distributions of these temperate orchids are those of *Cypripedium guttatum*, which is found from the Urals in European Russia, across Asia to the Aleutian Islands and Alaska, and of *Coeloglossum viride* which is also widespread throughout temperate Eurasia, N America and Greenland.

The wide distribution of *Eulophia zollingeri* has already been mentioned, but those of the two saprophytic epipogiums are even more remarkable. *Epipogium aphyllum* is widespread, but rather rare, throughout temperate Eurasia, while *E. roseum* is widespread in the Old World tropics from Africa and Asia to the Pacific Islands.

Conclusions

It cannot be emphasised strongly enough that the orchid flora of this region is still very poorly sampled. Of the 579 species confirmed as occurring, 101 (>17%) have been collected only once, while 232 (40%) are known from three or fewer collections (Table 4). One of the main purposes of this book is to encourage further work.

To demonstrate the riches that lie in store for future workers, the expedition made by the authors to Bhutan in May and June 2000 may be cited. During this short visit, we added six species to the Bhutan orchid flora: *Bulbophyllum gamblei* (Hook. f.) Hook. f., *B. griffithii* (Lindl.) Rchb. f., *B. secundum* Hook. f., *Calanthe brevicornu* Lindl., *Cymbidium dayanum* Rchb. f. and *Dendrobium spatella* Rchb. f., though all of these had previously been recorded from adjacent areas.

That the well protected forests of southern and central Bhutan have a rich orchid flora cannot be doubted; however, much more survey work is needed before the full inventory can be known. Orchid distribution and ecology are still very poorly understood and more information is urgently needed. Although forest destruction and over-collection for horticultural and medicinal purposes seem not to have significantly affected the Bhutanese orchid flora, in so far as we can determine, its future protection is dependent upon good information concerning distribution, ecology, biology and conservation status.

Table 4. Collections of three or fewer specimens from the Flora area.

Orchids known from a single collection in the Flora area	Orchids known from a single collection from Bhutan	Orchids known from two or three collections in the Flora area
101	32	131

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Thanks are due firstly to DANIDA, the Overseas Aid division of the Royal Danish Ministry of Foreign Affairs, for financial support of the Flora of Bhutan Completion Project. The present volume is published under their auspices; this support has covered the costs of printing, and the field trip to Bhutan undertaken by the authors in May and June 2000. We would like to thank the Royal Government of Bhutan for allowing us to visit, and to study the orchids of Bhutan in the field. This visit was organised by the Ministry of Agriculture and we would like to thank Lyonpo Dr Kinzang Dorji for the assistance and kindness which he and his staff extended to us during our visit, especially Yeshi Dorji, who acted as our guide, and Vinchen who drove us around the country with such care.

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The directors of the following herbaria allowed visits to their institutions, provided information, or lent specimens from their collections: BM, CAL, E, GB, K, KL, LINN, LIV, NBG, OXF, PE, S, THIM, TI, UPS, W. [Citations of specimens from LE are taken from Christenson, 1995]. The British Library permitted access to the Buchanan-Hamilton drawings in their collection.

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The authors are extremely grateful to Henry Noltie for his careful editing of this volume.

NEW COMBINATIONS

The following new combinations are published in this volume:

Chusua puberula (King & Pantling) N. Pearce & P.J. Cribb, p. 135.

Oreorchis sanguinea (N. Pearce & P.J. Cribb) N. Pearce & P.J. Cribb, p. 241.

ABBREVIATIONS AND NOTES ON TAXONOMIC TREATMENT

Most authorities are given in full, but the following (most frequently used ones) are abbreviated as follows: Bl., C.L. Blume; R. Br., R. Brown; A. DC., Alphonse de Candolle; DC., Augustine de Candolle; Griff., W. Griffith; Hook. f., J.D. Hooker; L., C. von Linnaeus; L.f., C. von Linnaeus (filius); Lindl., J. Lindley; Rchb. f., H.G. Reichenbach (filius); Roxb., W. Roxburgh; Schltr., F.R.R. Schlechter; Sw., O. Swartz; Wall., N. Wallich.

Abbreviations of book titles have been standardized using Stafleu & Cowan (1976–1988) and Stafleu & Mennega (1992 in progress); abbreviations of journal titles follow Bridson (1991).

Black and white figures

In the figures the scales are given as follows: single bar-line = 1 mm (unless otherwise stated); double bar-line = 1cm

Collections used for the Flora

Localities are mainly based on information from herbarium specimens (see Checklist of specimens examined, p. 587). However, a number of field records have also been included: P.J. Cribb (visit to Bhutan in 1998) and Pearce, Cribb & Dorji (visit to Bhutan in 2000).

Literature records are cited by author and date (see Bibliography, p. 605) except for the two most commonly used sources:

F.E.H. 2 – see Ohashi, 1975.

M.F.B. – see Rao & Balakrishnan, 1973.

Various other collectors have made special studies of Bhutanese orchids, and notes on some of these are required:

D.B. Gurung has made an orchid herbarium at his home in Lobesa. Some of these collections (and duplicates at E) have been examined by the authors, but ones which have not been seen are cited in the text as 'field records'.

Dr H. Kurzweil collected plants in Darjeeling and Sikkim in June and July 1983 and has kindly provided a list of these. Part of this collection has been deposited at K, KL, NBG or W and these specimens are cited here. The rest of his collection was lost in the mail on the way to Klagenfurt (Austria). These lost specimens, and ones for which no vouchers were made (including some collected live or as seeds and sent to HBV at the University of Vienna), are cited here as 'field records'.

Dr Marcus Würmli visited Bhutan in 1973 and examined and collected some orchids. A list of species seen and collected on this trip was published in 1973. Most of the plants were determined on the spot, but some critical collections were preserved in alcohol. Dr Würmli kindly tried to find this collection for us to examine but was unfortunately not able to do so. These collections are therefore cited as literature references.

R. Pantling The pre-eminent collections of orchids from Sikkim and Darjeeling by Robert Pantling date from between 1891 and 1899. There are, however, certain problems arising from the numbering system that he used for these collections. Pantling frequently used identical collection numbers for specimens of what he took to be the same species, but sometimes these were made at different localities and sometimes even in different years. Although in the majority of cases the different collections bearing the same number represent the same species, this is not always the case. Problems of typification have often arisen from this method of numbering. For example in some cases a sheet bearing the type number actually bears a date after that of the publication and therefore cannot be a type. In an attempt to resolve these problems each sheet has been given a letter in addition to the number; the letters have been used in alphabetical order according to the dates of collection (whether a year, or month within a year).

When citing the type material it has been assumed (a) that the holotype is the specimen at CAL; (b) that specimens in other herbaria are isotypes; (c) that collections with different dates, but dating from before the publication, are syntypes (unless a specific sheet can be identified from the protologue); (d) that material collected after the date of publication cannot be type material.

Notes on typification

Generic typification has followed Farr *et al.* (1979). A special effort has been made in this volume to typify all names used (including species now regarded as synonyms) since there has been so much confusion in the past.

In orchids, given the complexity of the flower structure and difficulties of preservation, many species are typified by illustrations. Three collections of illustrations by Indian or Chinese artists are of especial importance.

THE BUCHANAN-HAMILTON COLLECTION

Francis Buchanan (later Hamilton, known to botanists as Buchanan-Hamilton) commissioned numerous botanical paintings from Indian artists in India and Nepal. These include a number of important orchid plates from Nepal, some of which represent type material. There are two sets of these paintings: one is at the Linnean Society in London (along with Buchanan-Hamilton's own field notes) and represents the holotype material. There is a fine second set at the British Library included within the collection of paintings of Indian and Nepalese plants assembled by Lord Wellesley.

THE REEVES COLLECTION

There are four sets of paintings commissioned from Chinese artists, by John Reeves for the Royal Horticultural Society between 1805 and 1820. The top set is in the library of the R.H.S. in London, but has been damaged by water. A duplicate set, in much better condition, is at the Natural History Museum, also in London. Another, formerly in the collection of the Earl of Derby at Knowsley Hall, Liverpool has recently been sold to a private collector, and the whereabouts of the fourth set is unknown.

THE ROXBURGH *Flora Indica* DRAWINGS

The two major sets of this important collection are at the Royal Botanic Gardens, Kew (see Sealy, 1956) and the Calcutta Botanic Garden, Howrah (see Sanjappa, Thothakhri & Dam, 1994).

TYPIFICATION OF SPECIMENS IN THE 'WALLICH' HERBARIUM

The herbarium of the Honourable East India Company was assembled between 1815 and 1846 by Nathaniel Wallich and his collaborators, and is usually known under his name. The collection was brought to London by Wallich in 1828 and after extensive sorting the top set was deposited in the Linnean Society. In 1913 this was transferred to the Royal Botanic Gardens, Kew where it remains to this day.

Specimens are cited in the text by their catalogue number (e.g. 'Wall. Cat. 7380A'). It should be noted that these are not collector's numbers, but the collector's name has also been given, where known. Lindley examined the orchids in the Wallich Herbarium and gave many of them manuscript names which were published in the Wallich Catalogue as *nomina nuda*, many of which were later validated elsewhere.

There has been some confusion about specimens in the Wallich Herbarium collected from Sillet (Sylhet). Though presently in Bangladesh, the town of Sillet (24 53′N, 91 51′E) is close to the border with the Indian state of Meghalaya (formerly part of Assam). Many collectors, such as Francis de Silva, collected in the area, especially in the Khasia Hills above the town which are now in India, and it is not always possible to be sure to which country these records belong.

FAMILY 209. ORCHIDACEAE

Plants perennial, terrestrial, epiphytic or lithophytic, sometimes mycotrophic; growth monopodial or sympodial; roots adventitious, often aerial, sometimes assimilatory. *Stems* usually leafy, often with one or more swollen internodes forming pseudobulbs. *Leaves* usually entire, alternate or opposite, often distichous, plicate or convolute; membranous to coriaceous, often terete or reduced to scale-like bracts, usually sheathed. *Inflorescences* erect or pendent; spicate, racemose or paniculate, 1- to many-flowered; basal, lateral or terminal. *Flowers* small to large; zygomorphic; sessile or variously pedicellate; resupinate or non-resupinate. *Sepals* three, free or connate; dorsal sepal often dissimilar to lateral sepals; *lateral sepals* sometimes adnate to the column to form a saccate, conical or spur-like mentum. *Petals* three (medial petal distinguished from the others as the lip), usually free. *Lip* entire or variously lobed, often with ornamented calluses, with or without a basal spur or nectary. Column short or long, with or without a basal foot, winged or lacking wings; fertile anther one (rarely two or three), terminal or incumbent, cap-like or dehiscing; pollen often agglutinated into discrete masses called pollinia; *pollinia* mealy, waxy or horny, soft or hard, sectile or not, 2, 4, 6, or 8, sessile or attached by caudicles or stipes to one or two viscidia forming a pollinarium; stigma 3-lobed, midlobe often modified to form a rostellum. *Ovary* inferior, unilocular with parietal placentation or rarely 3-locular with axile placentation. Fruit a capsule, usually opening laterally; seeds numerous, dust-like.

Artificial key to genera

1. Plants mycotrophic (lacking green leaves and stems) 2
+ Plants not mycotrophic (with green leaves and stems) 14

2. Flowers campanulate, with sepals and petals fused/connate; resupinate 3
+ Flowers not campanulate, with sepals and petals free, spreading or connivent; resupinate or non-resupinate 4

3. Rootstock tuberous-moniliform; stem pale yellow; pollinia 2 (cleft) .... **4. Didymoplexis**
+ Rootstock not tuberous; stem brown; pollinia 2 (not cleft) .... **5. Gastrodia**

4. Pollinia soft or mealy, sectile 5
+ Pollinia hard, not sectile 10

5. Sepals and petals subtended by a denticulate calyculus (cup) .... **14. Lecanorchis**
+ Sepals and petals not subtended by a calyculus 6

6. Rootstock distinctly coralloid-tuberous; lip spurred; flowers resupinate or non-resupinate **6. Epipogium**
+ Rootstock rhizomatous or densely-rooted, like a bird's nest; lip lacking a spur 7

7. Rootstock with densely clustered roots, like a bird's nest .... **11. Neottia**
+ Rootstock rhizomatous 8

8. Plants large, scandent or erect; flowers in axillary racemes or a terminal panicle ... **13. Galeola**
+ Plants small, erect; flowers in a terminal raceme 9

9. Rhizome with roots; column elongate; lip obscurely lobed; pollinaria without a caudicle **7. Aphyllorchis**
+ Rhizome lacking roots; column short; lip distinctly lobed and T-shaped; pollinaria with a long caudicle .... **18. Chamaegastrodia**

10. Pollinia 4 11
+ Pollinia 2 13

11. Pollinaria lacking a distinct stipe; flowers non-resupinate; pseudobulbous
49. **Malaxis** (*M. aphylla* and *M. saprophyta*)
+ Pollinaria with a distinct stipe; flowers resupinate; rhizomatous 12

12. Ovary short; flowers many, small (less than 0.2cm across) .... 51. **Risleya**
+ Ovary very long; flowers few, medium-sized (more than 1cm across) .... 56. **Yoania**

13. Column with a distinct foot; inflorescence more than 6-flowered ... 57. **Eulophia** (*E. zollingeri*)
+ Column lacking a distinct foot; inflorescence fewer than 6-flowered
59. **Cymbidium** (*C. macrorhizon*)

14. Stamens 2 or 3; lateral anthers fertile; filaments only partially united with the column 15
+ Stamen 1; lateral anthers sterile or lacking; filaments united with the column to apex 17

15. Lip similar to petals; stamens 2-lobed, finger-like .... 1. **Apostasia**
+ Lip deeply slipper-shaped, column with shield-like staminode 16

16. Leaves cauline, plicate .... 2. **Cypripedium**
+ Leaves basal, conduplicate .... 3. **Paphiopedilum**

17. Anther firmly united with the column by its base; plants with root-stem tuberoids; pollinia sectile 18
+ Anther movably attached to column by its apex (through a connective); plants lacking root-stem tuberoids; pollinia sectile or not 36

18. Viscidia terminal; pollinia 4 19
+ Viscidia basal; pollinia 2 or 4 20

19. Flower single; lip with 2, short spurs; leaf cordate, more than 6mm long .... 29. **Corybas**
+ Flowers 2–3; lip spurless; leaf ovate, less than 5mm long .... 30. **Pantlingia**

20. Anther bent markedly backwards; lip with 2 spurs .... 47. **Satyrium**
+ Anther erect; lip spurless or with a single spur 21

21. Stigma lobes not stalked, not protruding (concave); stigma sessile, single; tuber fusiform or digitate 22
+ Stigma lobes stalked or protruding (convex); stigmas 2; tuber ovoid 29

22. Viscidia naked (without a bursicle) 23
+ Viscidia surrounded by 1 or 2 bursicles 28

23. Rootstock rhizomatous, without a tuber or finger-like tuberoids .... 32. **Aorchis**
+ Rootstock tuberous or with finger-like tuberoids 24

24. Lip papillose .... 43. **Neottianthe**
+ Lip not papillose 25

25. Petals fused basally with column base .... 34. **Brachycorythis**
+ Petals not fused with column base 26

26. Rostellum with a distinct mid-lobe between anthers .... 39. **Gymnadenia**
+ Rostellum without a mid-lobe or with a small swelling between the anthers 27

27. Lip elongate, oblong; basally with 2 lateral keels, a median keel and 2 transverse lamellae ...... **36. Coeloglossum**
+ Lip entire to 3-lobed; lacking basal keels or lamellae ...... **46. Platanthera**

28. Rostellum small, narrow; bursicles formed from the rostellum ...... **35. Chusua**
+ Rostellum broad; bursicles formed from the incurved front ends of the lateral lobes of the rostellum and the inner surfaces of the anther canals ...... **41. Hemipilia**

29. Lip flat to concave at base, but not spurred 30
+ Lip spurred at base 31

30. Lip entire ...... **31. Androcorys**
+ Lip 2- to 5-lobed ...... **42. Herminium**

31. Anthers with a broad connective, canals elongate; spur of lip long ...... **44. Pecteilis**
+ Anthers with a narrow connective, canals short; spur of lip short 32

32. Staminodes equalling the column, filiform ...... **37. Diphylax**
+ Staminodes much shorter than the column, not filiform 33

33. Stigmas conjoined, lacking projecting arms ...... **33. Bhutanthera**
+ Stigmas conjoined or 2-lobed, with projecting arms 34

34. Lip with a small callus of 1–3 swollen ridges at base; stigma lobes separated and fused to the base of the lip and staminodes ...... **45. Peristylis**
+ Lip lacking a basal callus; stigma lobes not fused 35

35. Mid-lobe of rostellum plate-shaped, porrect, overtopping the anthers; stigma lobes connected by a membrane; lip entire, flabellate with a small apiculus ...... **38. Diplomeris**
+ Lip not as above ...... **40. Habenaria**

36. Pollinia granular, occasionally mealy, 2 or 4 37
+ Pollinia waxy or cartilaginous, 2, 4 or 8 54

37. Anther incumbent at top of column 38
+ Anther erect on back of column 42

38. Flowers appearing before the leaf on leafless scapes; leaf solitary, soft, plicate ...... **12. Nervilia**
+ Flowers appearing with leaves on terminal inflorescences; leaves more than one 39

39. Leaves conduplicate in bud 40
+ Leaves convolute, plicate in bud 41

40. Pollinia 2; plants small; leaves 2, opposite; flowers small, relatively insignificant ... **10. Listera**
+ Pollinia 8; plants tall, reed-like; leaves distichous along stems; flowers large, showy **75. Arundinia**

41. Ovary sessile; epichile of lip distinctly ridged ...... **8. Cephalanthera**
+ Ovary pedicellate; epichile of lip with hump-like calluses, not ridged ...... **9. Epipactis**

42. Stem rhizomatous, decumbent, rooting at nodes 43
+ Stem caespitose with fasciculate roots 52

43. Column with 2 wing-like, longitudinal keels on front 44
+ Column lacking wing-like keels on front 47

44. Flowers non-resupinate (lip uppermost in the flower) .... **23. Hetaeria**
+ Flowers resupinate (lip lowermost in the flower) 45

45. Lip spurred at base .... **17. Anoectochilus**
+ Lip spurless but saccate 46

46. Hypochile of lip small, saccate; mesochile of lip toothed or simple .... **25. Odontochilus**
+ Hypochile of lip large, saccate; mesochile of lip untoothed .... **26. Rhomboda**

47. Stigmas united or solitary under the rostellum 48
+ Stigmas 2, separated on each side of the rostellum 50

48. Lip hypochile hairy within .... **21. Goodyera**
+ Lip lacking hairs within 49

49. Spur short and dorsi-ventrally flattened; disc of lip lacking callus .... **20. Erythrodes**
+ Spur long and slender; disc of lip with 2 flat calluses .... **22. Herpysma**

50. Sepals united to form a short to long tube .... **19. Cheirostylis**
+ Sepals free to base 51

51. Lip with a long claw; stigmas on a short process; inflorescence 1- or 2-flowered
24. Myrmechis
+ Lip with a short claw; stigmas sessile (not on a process); inflorescence several-flowered
27. Zeuxine

52. Roots fleshy; leaves soft, conduplicate; flowers arranged in a spiral inflorescence
28. Spiranthes
+ Roots fibrous; leaves plicate; flowers in a raceme or panicle (not spirally arranged) 53

53. Inflorescences axillary; flowers resupinate; lip without a saccate base .... **15. Corymborkis**
+ Inflorescences terminal; flowers non-resupinate; lip with a saccate base .... **16. Tropidia**

54. Plant growth sympodial 55
+ Plant growth monopodial 109

55. Plants terrestrial 56
+ Plants epiphytic or lithophytic 80

56. Pollinia 2 57
+ Pollinia 4 or 8 61

57. Pseudobulbs alternately either leaf-bearing or inflorescence-bearing 58
+ Pseudobulbs not as above 59

58. Lip 3-lobed; column winged, lacking a foot .... **70. Chrysoglossum**
+ Lip simple; column not winged, with a foot .... **71. Diglyphosa**

59. Inflorescence crozier-shaped, curved, strongly decurved .... **58. Geodorum**
+ Inflorescence not curved or decurved 60

60. Lip spurred at base; pollinia simple .... 57. **Eulophia**
\+ Lip not spurred; pollinia deeply cleft .... 59. **Cymbidium** (in part)

61. Pollinia 4 62
\+ Pollinia 8 69

62. Pollinia naked, lacking a caudicle or stipe and viscidium 63
\+ Pollinia with a caudicle or stipe and viscidium 65

63. Flowers non-resupinate .... 49. **Malaxis**
\+ Flowers resupinate 64

64. Lip spurless; column usually more than 1mm long .... 48. **Liparis** (in part)
\+ Lip shortly spurred; column very short (less than 0.5mm long) .... 53. **Didiciea**

65. Pollinia mealy, soft; sepals connate into a slender tube; flowers borne at an angle to the ovary
63. **Anthogonium**
\+ Pollinia firm or hard; sepals free; flowers not as above 66

66. Pollinarium lacking a stipe or caudicle but with a viscidium; column elongate .. 52. **Cremastra**
\+ Pollinarium with a stipe or caudicle and a viscisium; column medium in length 67

67. Lip long-spurred .... 55. **Tipularia**
\+ Lip lacking a spur 68

68. Column simple; pollinia not deeply cleft .... 54. **Oreorchis**
\+ Column complex; stelidia long with swollen tips; rostellar arms long; pollinia deeply cleft
60. **Acriopsis**

69. Sepals connate to form a broad, fleshy cup .... 61. **Acanthephippium**
\+ Sepals free 70

70. Stem with 1 leaf 71
\+ Stem with 2 or more leaves 75

71. Leaf grass-like; lip with prominent turberculate ridges .... 67. **Pachystoma**
\+ Leaf not grass-like; lip lacking tuberculate ridges 72

72. Leaf sessile, cordate 73
\+ Leaf long-petiolate, elliptic-lanceolate 74

73. Flowers resupinate; lip not spurred .... 72. **Mischobulbum**
\+ Flowers non-resupinate; lip spurred .... 73. **Nephelaphyllum**

74. Pseudobulb ovoid; column narrowly winged from base to apex .... 62. **Ania**
\+ Pseudobulb fusiform; column winged only at apex .... 74. **Tainia**

75. Column with a prominent foot; inflorescence densely pubescent .... 66. **Eriodes**
\+ Column lacking a prominent foot; inflorescence not densely pubescent 76

76. Column prominently winged .... 69. **Spathoglottis**
\+ Column not prominently winged 77

77. Leaves grass-like; lip with tuberculate ridges .... **67. Pachystoma**
+ Leaves not grass-like; lip lacking tuberculate ridges 78

78. Column connate with lip base .... **64. Calanthe**
+ Column attached to lip at base only 79

79. Lip lacking a spur or sac at the base .... **65. Cephalantheropsis**
+ Lip spurred or saccate at base .... **68. Phaius**

80. Pollinia 2 81
+ Pollinia 4 or 8 82

81. Pseudobulbs with 2 or more leaves .... **59. Cymbidium** (in part)
+ Pseudobulbs with 1 leaf .... **98. Acrochaene**

82. Pollinia 4 83
+ Pollinia 6 or 8 101

83. Pollinia naked, lacking caudicles or stipes 84
+ Pollinia with caudicles or stipes 89

84. Inflorescence terminal; flowers lacking a distinct column foot, mentum or spur; pollinia clavate 85
+ Inflorescence subterminal, lateral or arising from rhizome; flowers with a column foot; lateral sepals forming a mentum 86

85. Leaves not equitant or ensiform; plants with pseudobulbs .... **48. Liparis** (in part)
+ Leaves equitant, ensiform; plants lacking pseudobulbs .... **50. Oberonia**

86. Lip mobile, movably hinged to column foot; mentum saccate .... **99. Bulbophyllum**
+ Lip not mobile, not hinged at base; mentum spur-like 87

87. Stem branched, branches formed by chains of superposed, sessile pseudobulbs; each pseudobulb with a terminal leaf; flowers lasting only one day .... **97. Flickingeria**
+ Stems unbranched, short or tall; leaves equitant and fleshy or membranous 88

88. Pseudobulbs elongate, ovoid or clavate, often tufted; leaves more than 2, deciduous or persistent; inflorescence racemose, flowers often large and attractive .... **95. Dendrobium**
+ Pseudobulbs short, ovoid, erect, arising from a creeping rhizome; leaves 1 or 2, coriaceous, persistent; flowers solitary from between leaves .... **96. Epigenium**

89. Pollinia with stipes 90
+ Pollinia with caudicles 92

90. Stipe 1 .... **101. Monomeria**
+ Stipes 2 91

91. Stipes linear; viscidia 2 .... **100. Ione**
+ Stipes Y-shaped or horseshoe-shaped; viscidium single .... **102. Sunipia**

92. Stems not pseudobulbous; leaves distichous 93
+ Stem pseudobulbous, 1-noded; leaves not distichous 94

93. Stem thick, fleshy; flowers large (more than 4cm across) .... 76. **Thunia**
+ Stem slender, not fleshy; flowers small (less than 0.5cm across) .... 92. **Podochilus**

94. Lip lacking a spur or saccate base 95
+ Lip with a spur, or saccate at base 97

95. Lip sigmoidally curved at base .... 82. **Panisea**
+ Lip not sigmoidally curved at base 96

96. Lip 3-lobed, not convolute around the column; inflorescence usually more than 2- flowered; leaves not deciduous; pseudobulbs perennial .... 78. **Coelogyne**
+ Lip entire to obscurely lobed, convolute around the column; inflorescence 1- or 2- flowered; leaves deciduous; pseudobulbs annual .... 84. **Pleione**

97. Pseudobulbs produced singly from a creeping rhizome 98
+ Pseudobulbs foming a chain, joined apex to base 100

98. Lip distinctly spurred at base .... 77. **Bulleyia**
+ Lip saccate, not distinctly spurred 99

99. Flowers not funnel shaped at base (sepals and petals spreading); column short 79. **Dickasonia**
+ Flowers funnel shaped at base; column elongate .... 80. **Neogyna**

100. Column long; lip unlobed; floral bracts deciduous .... 81. **Otochilus**
+ Column short; lip lobed; floral bracts persistent .... 83. **Pholidota**

101. Pollinia 6 .... 91. **Appendicula**
+ Pollinia 8 102

102. Sepals connate to form a tube 103
+ Sepals free 104

103. Pseudobulbs ovoid to cylindric; flowers many, secund .... 87. **Cryptochilus**
+ Pseudobulbs discoid; flowers 1–3 .... 89. **Porpax**

104. Lip with a sac shaped hypochile separated from the epichile by a transverse ridge .... 85. **Agrostophyllum**
+ Lip lacking a transverse ridge 105

105. Pollinia joined by a long, slender caudicle 106
+ Pollinia not joined by a long caudicle 107

106. Operculum horizontal on top of column, unbeaked; column foot short .... 93. **Phreatia**
+ Operculum vertical behind column, beaked; lacking a column foot .... 94. **Thelasis**

107. Column with vertical arms or lobules containing the stigmas .... 86. **Ceratostylis**
+ Column lacking arms or lobules 108

108. Leaves and sheaths not hairy .... 88. **Eria**
+ Leaves or leaf sheaths hairy; hairs red-brown .... 90. **Trichotosia**

109. Pollinia 4 110
+ Pollinia 2 126

110. Pollinia 4, equal; lacking a column foot .... 128. **Taeniophyllum**
+ Pollinia 4, unequal; with a column foot 111

111. Column with a distinct foot 112
+ Column lacking a distinct foot 114

112. Lip with a distinct spur .... 109. **Cleisocentron**
+ Lip lacking a spur 113

113. Plants leafless; stipes linear to oblong, about twice as long as diameter of pollinia .... 108. **Chiloschista**
+ Plant with leaves; stipes broad, shorter than diameter of pollinia .... 129. **Thrixspermum**

114. Lip adnate to column, not mobile 115
+ Lip mobile 125

115. Lip lacking a spur or sac at base 116
+ Lip with a distinct spur or sac at base 117

116. Plants small, short-stemmed; lip exceeding the dorsal sepal, apex bifurcate ... 111. **Diploprora**
+ Plants large, with a long stem; lip shorter than the dorsal sepal, apex not bifurcate .... 132. **Vandopsis**

117. Spur lacking a longitudinal septum 118
+ Spur with a longitudinal septum 123

118. Spur lacking calluses or ornaments on back wall within 119
+ Spur with calluses or ornaments on back wall within 122

119. Stipes four times as long as diameter of the pollinia; mid-lobe of lip fimbriate-dentate .... 116. **Ornithochilus**
+ Stipes twice as long as diameter of the pollinia; mid-lobe of lip not fimbriate-dentate 120

120. Lip base lacking a transverse ridge or callus at entrance to spur .... 124. **Schoenorchis**
+ Lip base with a transverse ridge or callus at entrance to spur 121

121. Plants large; spur pubescent within .... 103. **Acampe**
+ Plants small; spur not pubescent within .... 125. **Smitinandia**

122. Back wall tongue of spur not pilose, not close to entrance of spur .... 119. **Pomatocalpa**
+ Back wall tongue of spur pilose, close to entrance of spur .... 126. **Staurochilus**

123. Rostellum lacking long arms .... 110. **Cleisostoma**
+ Rostellum with long arms 124

124. Rostellum with long, oblique, twisted, upturned arms .... 115. **Micropera**
+ Rostellum with long, porrect and downturned arms .... 127. **Stereochilus**

125. Sepals and petals narrow, not fleshy; nectary on lip spur-like .... 105. **Arachnis**
+ Sepals and petals broadly ovate, fleshy; nectary on lip a small, flat convexity ... 112. **Esmeralda**

126. Pollinia cleft or split 127
+ Pollinia porate 135

127. Column lacking a foot 128
+ Column with a distinct foot 132

128. Stipes short, broad .... **131. Vanda**
+ Stipes linear 129

129. Apex of stipes forward-curved, S-shaped .... **130. Uncifera**
+ Apex of stipes simple, linear 130

130. Lip unlobed .... **121. Rhynchostylis**
+ Lip 3-lobed 131

131. Plants large; inflorescence densely flowered; flowers more than 5mm across, fleshy **122. Robiquetia**
+ Plants small; inflorescence laxly flowered; flowers less than 3mm across, thin-textured **123. Saccolabiopsis**

132. Leaves terete .... **117. Papilionanthe**
+ Leaves not terete 132

133. Spur placed centrally on lip; epichile reduced .... **120. Pteroceras**
+ Spur, where present, from hypochile of lip; epichile not reduced 134

134. Inflorescence densely many-flowered; lip lacking a bifurcate callus .... **104. Aerides**
+ Inflorescence laxly few-flowered; lip with a bifurcate callus .... **118. Phalaenopsis**

135. Lip mobile .... **107. Biermannia**
+ Lip not mobile 136

136. Leaves terete; lip lacking a spur or sac .... **114. Luisia**
+ Leaves dorsi-ventrally flattened; lip with a spur or sac 137

137. Lip long-spurred .... **106. Ascocentrum**
+ Lip saccate at base, but never long-spurred .... **113. Gastrochilus**

ORCHIDS WITH 2 OR 3 FERTILE ANTHERS

Subfamily **APOSTASIOIDEAE** Rchb. f.

1. Apostasia Bl.

Plants terrestrial, glabrous; *roots* terete, branched, fibrous, tuberculate. *Stem* erect, simple, slender. *Leaves* spirally arranged, veined, linear-lanceolate. *Inflorescence* terminal, erect or spreading, racemose or paniculate, pendent; bracts present. *Flowers* sessile, yellow or white; ovary ellipsoid. *Sepals* and *petals* similar, free, keeled. Column erect; style free in upper portion, lower part adnate to filaments; stamens 2, with staminode.

The genus *Apostasia* was established in 1825 by the Dutch botanist Carl Ludwig Blume in his *Bijdragen tot de Flora van Nederlandsche Indië*. The genus comprises about 14 species distributed from the Himalayas, through SE Asia and the Malay Archipelago to Australia.

Some authors have treated the Apostasioids as a distinct family more closely related to the Burmanniaceae or the Hypoxidaceae, but de Vogel (1969) argued that because of the basic orchid symmetry, the fusion of the filaments to the base of the style and resupination of the flowers, this similarity is only superficial. Recent treatments by Dressler (1981, 1993) and Pridgeon *et al.* (1999) agree and place *Apostasia* and *Neuwiedia* together in the subfamily Apostasioideae. Dressler (1993) suggested that the closely related genus *Neuwiedia* might be considered an ur-orchid and represent an ancestor of the orchid family.

Vogel (1981) has suggested that pollination is by bees that vibrate the flower to release pollen from the anthers. This mechanism is similar to that found in *Solanum* and in the family *Melastomataceae* and the flower structure resembles other flowers known to be pollinated in this way.

TYPE. *Apostasia odorata* Bl.

ETYMOLOGY. From the Greek *apostasia* (separation or divorce), suggested by the unique features which separate this genus from other orchids.

Section **Apostasia**

1. **A. wallichii** R. Br. in Wall., Pl. Asiat. Rar. 1(4): 75, t.84 (1829). Type: Nepal, Naokote, coll. *Wallich* Wall. Cat. 4448 (holo. K-LINDL!, iso. E! K-W! K! W!).

Mesodactyles deflexa Wall. ex R. Br. in Wall., Pl. Asiat. Rarior. 1(4): 74 (1829), nom. nud.

Niemeyara stylidioides F. Mueller, Fragm. 6: 69 (1867). Type from Australia.

Apostasia stylidioides (F. Mueller) Rchb. f. in Flora 55: 278 (1872).

A. gracilis Rolfe in J. Linn. Soc., Bot. 25: 242 (1889). Type from Borneo.

A. alba Rolfe, loc. cit. (1889); Orchid Rev. 4: 329 (1896). Type from Borneo.

A. lucida Bl. ex Siebe, Anat. Bau. Apost.: f.3 (1903). Type not located.

A. papuana Schltr. in Lauterbach & Schumann, Fl. Schutzgeb. Südsee 2: 72 (1905). Type from New Guinea.

A. wallichii var. *seraweiensis* J.J. Smith in Mitt. Inst. Allg. Bot. Hamburg 7: 10 (1927). Type from Borneo.

A. curvata J.J. Smith, op. cit. 11 (1927). Type from Borneo.

A. nipponica Masamune in J. Jap. Bot. 11: 46 (1935). Type from Japan.

A. wallichii var. *nipponica* (Masamune) Masamune in Rep. (Annual) Noto Mar. Lab. 3: 63 (1963).

A. wallichii subsp. *nipponica* (Masamune) Masamune in J. Geobot. 11(4): 129 (1963).

Plant up to 50cm tall; *roots* uniform, cylindric, rigid, fibrous, with storage nodules, up to 20cm long. *Stem* wiry, covered by leaf bases, up to 25cm tall. *Leaves* dark green, linear-lanceolate, acuminate, plicate, spiral with sheathing bases, 10–18 × 0.8–1.5cm. *Inflorescence* paniculate, decurved, many-flowered, 12–20cm long; floral bracts lanceolate, acuminate, 3–4 × 1–1.5mm. *Flowers* fragrant, 5–8 × 5–8mm; uniformly yellow; ovaries erect, 1.4–1.6cm long. *Sepals* similar, linear-lanceolate, cuspidate, tips spreading, 3-veined, 4–5.8 × 1.4–1.6mm. *Petals* and lip similar, linear-oblong, obtuse, 1-veined, 4–5.8 × 1.4–1.6mm. *Column* with 2 erect filaments, adnate to base of style with finger-like staminode; anthers oblong, 3–4mm long; style slender, c.2.8mm long; staminode slender, appressed to column, c.2.6mm long. *Fruit* narrowly fusiform, 1.5–2 × 0.06–0.1cm. **Fig. 1.**

Darjeeling (Dulkajhar, Sabargam); **Sikkim** (Tista River). Moist humus-rich soils in shady evergreen forest, on granite; up to c.1700m. Fl. April; Fr. October.

GENERAL DISTRIBUTION. India, Myanmar, Thailand, Indo-China, S China, Japan, Malaysia and Indonesia to New Guinea and N Queensland.

ETYMOLOGY. Named after Nathaniel Wallich (1786–1854) who was born in Copenhagen and went as a surgeon to the Danish settlement at Serampore. In 1813 he entered the service of the British East India Company and from 1815–1841 he was Superintendent of the Calcutta Botanic Garden. During this time he travelled extensively and collected plants in Nepal. His herbarium collection and catalogue names were used extensively by John Lindley in his *Genera and Species of Orchidaceous Plants* (1830–40).

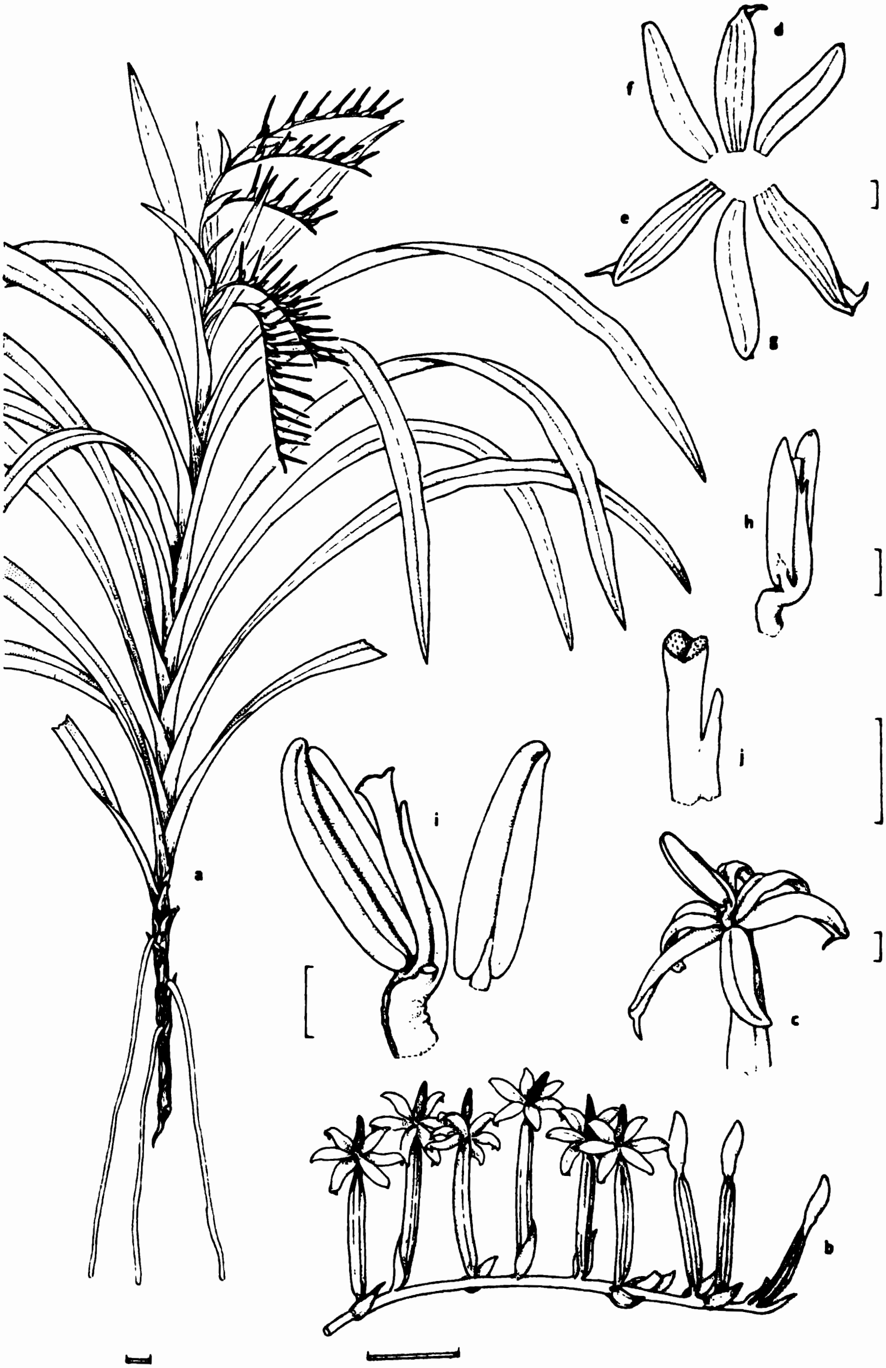


Fig. 1. **Apostasia wallichii**: a, habit; b, inflorescence (detail); c, flower; d, dorsal sepal; e, lateral sepals; f, petals; g, lip; h, column; i, column, anthers and staminode (detail); j, column (with detail of staminode). Drawn by Susanna Stuart-Smith, a from *Jenkins* (K); b–j from *Clarke* 44442 (K).

1. APOSTASIA

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

A. odorata Bl., Bijdr.: 423, t.5 (1825). Type: Java, *Blume* s.n. (lecto. L! Herb. no. 9023221149).
NOTE. Reported by Hegde & Rao (1987) from Tipi in the W Kameng district, but we have seen no material from our area.

Subfamily CYPRIPEDIOIDEAE Lindl.

2. Cypripedium L.

Plants terrestrial, stems less than 1m tall, rhizomatous. *Leaves* 1 to several, plicate, deciduous, reniform-ovate to lanceolate. *Inflorescence* terminal, 1- to several-flowered; peduncle short to long; floral bracts leafy. *Flowers* showy. *Dorsal sepal* erect or porrect over lip; *lateral sepals* united to form a synsepal. *Petals* spreading, linear-lanceolate, sometimes twisted. *Lip* deeply saccate, margins inrolled. *Column* porrect; staminode peltate-ovate to trowel-shaped; anthers 2, behind staminode.

The genus *Cypripedium* was established in 1753 by Linnaeus, in the first edition of his *Species Plantarum*. A revision of the genus, with sectional delimitation and full synonymy, can be found in Cribb (1997). The genus comprises about 47 species widely distributed in N America south to Mexico, Guatemala and Honduras, Europe, temperate Asia, Taiwan and Japan.

Most species of the genus are pollinated by various species of small bee (Andrenidae, Megachilidae or Halictidae) while the large N American *C. acaule* Aiton is pollinated by bumble-bee queens. Vogt (1990) reports syrphid flies and flower beetles as the pollinators of the N American species *C. reginae* Walter. The slipper orchid flower is a one-way trap that offers no reward. The pollinating insects, probably young and naïve, are attracted to the flower by deceit. The insects enter by the orifice of the slipper-shaped lip in front of the staminode and, after falling into it, can only crawl out beneath the stigma and anthers, emerging at the base of the column through one of two small orifices. After a few visits the insects learn to avoid the flower which may explain the low pollination rate in some species.

LECTOTYPE. *Cypripedium calceolus* L.
ETYMOLOGY. Named from the Greek *Cypros* (Cyprus), the island sacred to Venus, and the Greek *pedion* (slipper), a reference to the popular name of Venus' slipper orchid.

Key to species

1. Plant 2-leaved 2
+ Plant 3- to 6-leaved 3

2. Plant more than 12cm tall; leaves subopposite; sepals and petals white spotted with purple **4. C. guttatum**
+ Plant less than 12cm tall; leaves opposite; sepals and petals claret or green, unspotted **5. C. elegans**

3. Flowers with green or pale green sepals and petals, and a white lip; ovary glandular **1. C. cordigerum**
+ Flowers claret, maroon or green; ovary eglandular 4

4. Leaves 3–4; dorsal sepal broader than synsepal; flowers usually less than 5cm across; lip margin purple, often toothed; ovary densely villose .... **2. C. himalaicum**
+ Leaves 6; dorsal sepal as wide as synsepal; flowers usually more than 5cm across; lip margin usually white, untoothed; ovary glabrous or sparsely hairy .... **3. C. tibeticum**

Section **Cypripedium** subsection **Cypripedium**

1. **C. cordigerum** D. Don, Prodr. Fl. Nepal: 37 (1825). Type: Nepal, Gossainthan, *Wallich* s.n. (holo. BM!).

Plant 22–60cm tall; *rhizome* short, stout. *Stem* solitary, slender to stout, increasingly pubescent and glandular from base upwards, up to 55cm long and 3–8mm in diameter; basal tubular sheaths 3–4. *Leaves* 2–5, distant along stem, elliptic to broadly elliptic, acute to acuminate, glabrous above and below, sparsely ciliate on the lower margins, 8–18 × 3.5–10.5cm. *Inflorescence* 1-flowered; peduncle 4–15cm long; floral bract leaf-like, elliptic to lanceolate, acuminate, pubescent on veins of lower surface, ciliate, 6–9 × 1.5–4cm. *Flowers* variable in size; sepals and petals green or pale green (rarely white or pale yellow), lip white spotted with pink within, staminode yellow with red spotting; pedicel and ovary densely glandular, 3–4cm long. *Dorsal sepal* lanceolate, acuminate, pubescent at base on inner side and on outside, ciliate towards apex, 1.4–2cm wide; *synsepal* narrowly elliptic, with 2 free acuminate tips, pubescent on outside, ciliate, 3.5–5 × 1–1.7cm. *Petals* lanceolate or linear, tapering above, acuminate, pubescent at base, 2.8 × 0.5–1.1cm. *Lip* slipper-shaped, porrect, somewhat ellipsoid or globose, dorsiventrally flattened, with a small mouth, 2.5–3.5cm long; lateral lobes infolded and creased. *Column* 1–1.5cm long; staminode oblong to trowel-shaped, obtuse, slightly longitudinally concave, glabrous, c.9 × 5mm. **Plate 1.**

Bhutan: C – Ha (Damthang, Tare La), Thimphu (Chanana), Punakha (Phobsikha, Wangdi Phodrang (field record)) and Bumthang (Shabjetang to Bumthang Chu, Lami Gompa, Ura La to Byakar, Yuto La) districts. **Chumbi** (Yatung). In wet and shady woods, open *Abies*, *Picea*, *Pinus wallichiana* and *Tsuga* forest, on outskirts of forest or in open glades, in *Caragana*, *Juniperus* and dwarf bamboo scrub, on S-facing slopes; 2100–4000 m. Fl. May–August.

GENERAL DISTRIBUTION. W Himalayas, through Kashmir, N India, Nepal to China (Xizang).
ETYMOLOGY. From the Latin *cordi-* (heart-shaped) and *gero* (to carry, bear).
NOTE. *C. cordigerum* is readily distinguished from other Asiatic species by its distinctive green and white flower, borne at the apex of a long, glandular peduncle and pedicel, and the deeply divided apex of the synsepal.

Section **Cypripedium** subsection **Macrantha** (Kränzlin) P.J. Cribb, The Genus Cypripedium: 190 (1977).

2. **C. himalaicum** Rolfe in J. Linn. Soc., Bot. 29: 319 (1892). Type: India, Sikkim, *Hooker & Thomson* 317 (holo. K!).
Cypripedium macranthum sensu Hook. f., Fl. Brit. India 6(1): 170 (1890), *non* Sw.
C. macranthum var. *himalaicum* (Rolfe) Kränzlin, Orchid. Gen. Sp. 1: 26 (1897).

Plant 14–30cm tall; *rhizome* elongate, 2–4mm in diameter. *Stem* erect, short, sparsely pubescent, 4–20cm long; basal tubular sheaths 2–3. *Leaves* 3–4, closely spaced on stem, elliptic-ovate, acute, slightly pubescent on upper surface, glabrous beneath, ciliate, 5–10 × 2.4–4.7cm. *Inflorescence* 1-flowered; peduncle pubescent above, 3–10cm long; floral bract lanceolate, acuminate, 3.2–6 × 0.5–1.3cm. *Flower* very fragrant, c.6cm across; claret and green, crimson-purple or reddish-chocolate, column yellow; pedicel and ovary long, pubescent, 1.6–2.9cm long. *Dorsal sepal* ovate-elliptic, shortly acuminate to acute, glabrous, 2.4–2.8 × 1.8–2cm; *synsepal* deeply concave, oblong-lanceolate, acute, glabrous, 1.8–2.2cm long. *Petals* lanceolate to linear-lanceolate, acute, pubescent at base, ciliate, 2.3–3.4 × 0.6–0.7cm. *Lip* slipper-shaped, bulbous, bilaterally compressed, mouth small, with a dentate margin, 2.8–3.4cm long; lateral lobes incurved, creased. *Column* 2-horned, 7–9mm long; staminode trowel-shaped to weakly cordate, obtuse to truncate, longitudinally concave, 0.7–1 × 0.44–0.55cm; *stigma* large, warty, c.4mm long. **Fig. 2; Plate 1.**

Bhutan: C – Ha/Thimphu (Chelai La), Thimphu (Chekha, Shodug to Barshong, Thimphu Chu) and Bumthang (Chakong, Towli Phu) districts; N – Upper Mo Chu (Chebesa to Lingshi, Lingshi Dzong, Tharizam Chu), Upper Pho Chu (Lunana, Wachhey), Upper Bumthang Chu (Chamka, Pangotang) and Upper Kulong Chu (Shingbe to Me La) districts; **Sikkim** (Lachen Valley); **Chumbi** (Chago La). Among grass-clad limestone boulders, in crevices, amongst small shrubs on steep hillsides, in alpine pastures with *Primula sikkimensis* and *Rhododendron anthopogon* and in *Cassiope* scrub, in partial shade in subalpine *Betula utilis* forest; 2800–4900m. Fl. May–July.

GENERAL DISTRIBUTION. NW India, Nepal and China (SE Xizang).

ETYMOLOGY. From the Latin *himalaicus* (of the Himalayas).

NOTES. The most distinctive features of this flower are the dorsal sepal, which is much broader than the synsepal, and the lip, which is somewhat bulbous in side view, bilaterally compressed and has a dentate margin to the orifice. *C. himalaicum* is sympatric with *C. tibeticum* but is distinguished in having smaller flowers with a distinctive lip and densely pubescent ovary. Hara (1971) reported a number of specimens under *C. macranthum* Sw. which are referable to *C. himalaicum*.

Lucksom (1994a) reported the rediscovery of this species in the Lachen valley of Sikkim.

3. C. tibeticum King ex Rolfe in J. Linn. Soc., Bot. 29: 320 (1892). Types: China, Szechuan (Sichuan), Tachienlu (Kangding) *Pratt* 301 (lecto. K!), selected by Cribb in The Genus Cypripedium: 208 (1997); China, *Pratt* 14, 42, 736 (syn. K!, isosyn. BM!), India, Sikkim, Chumbi and Phari, *Dungboo* s.n. (syn. K!).

Cypripedium macranthum var. *ventricosum* Hook. f., Fl. Brit. India 6(1): 170 (1890). Type: Chumbi, cited above.

C. corrugatum Franchet in J. Bot. (Morot) 8: 251 (1894). Types: China, Yunnan, Ma-eul-chan, *Delavay* 3478 (syn. P!, isosyn. K!), Yunnan, Yent-ze-hay, *Delavay* 3478 (syn. P!, isosyn. K!).

C. corrugatum var. *obesum* Franchet, loc. cit. (1894). Types: China, Yunnan, Lienyn, *Delavay* s.n. (syn. P!, isosyn. K!); China, Koutoui, *Delavay* s.n. (syn. P!, isosyn. K!).

C. macranthum var. *tibeticum* (King ex Rolfe) Kränzlin, Orchid. Gen. Sp. 1: 26 (1897).

C. langrhoa Constantin in Bull. Mus. Natl. Hist. Nat. 25: 221 (1919), *nom. provis.*

C. compactum Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 12: 327 (1922). Type: China, Szechuan (Sichuan), Tatsienlu (Kangding), *Limpricht* 1647 (holo. B†, iso. K!).

Plant robust, 13–35cm tall; *rhizome* creeping, short. *Stem* erect, glabrous, leafy. *Leaves* up to 6; the lower 3 reduced to basal sheaths; uppermost 3 orbicular to elliptic-ovate, obtuse to acute, ciliate, glabrous on both surfaces, 7–15 × 3.3–7.2cm. *Inflorescence* 1-flowered, usually produced before the leaves have fully developed; floral bract overtopping the flower, elliptic to ovate-lanceolate, acute or acuminate, 5–10.5cm long. *Flower* pendent; purple or dark maroon, sepals and petals with darker veins, usually with a darker lip with a white margined rim to the mouth; pedicel and ovary glabrous or rarely slightly pubescent towards the apex, 2–3.2cm long. *Dorsal sepal* ovate-elliptic, acuminate to shortly mucronate, sparsely ciliate, 3–5.2 × 2.2–3cm; *synsepal* elliptic-ovate, bifid at tip, sparsely ciliate towards the apex, 3–3.5 × 1.8–2cm. *Petals* incurved-porrect to spreading and decurved, oblong-lanceolate, acuminate to acute, sparsely ciliate, pubescent on base of inner surface, 3.6–6 × 1.4–2.5cm. *Lip* slipper-shaped, deeply ventricose, mouth circular to elliptic, crimped, hairy within, broader than deep, 3.5–6 × 3.5–6cm. *Column* short; staminode subsessile, cordate to trowel-shaped, more or less flat, glabrous, 1.5–2 × 0.8–1.2cm.

Bhutan: C – Thimphu (Pyemitangka), Punakha (Tang Chu to Ritang) and Bumthang (Bumthang, Kamephu, Ura) districts; N – Upper Mo Chu (near Laya, Lingshi, Naha), Upper Mangde Chu (Mangde Chu) and Upper Bumthang Chu (Chamka, Pangotang) districts; **Sikkim** (Lachen Valley); **Chumbi** (Phari Dzong). Open montane meadows, margins of coniferous and mixed woodlands, open limestone ledges and screes; 2300–4200m. Fl. June–July.

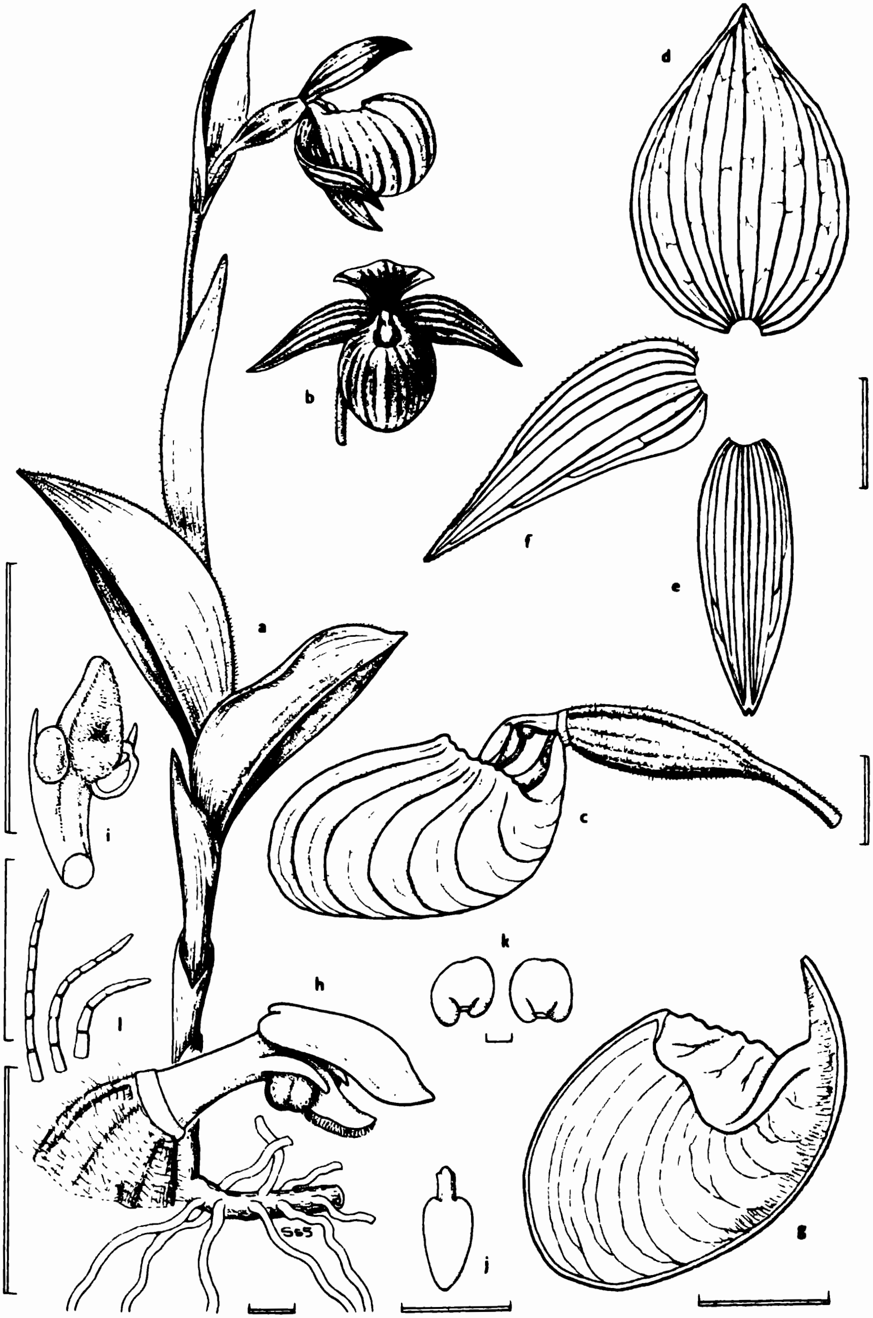


Fig. 2. **Cypripedium himalaicum**: a, habit; b, flower; c, lip, column and ovary (from side); d, dorsal sepal; e, synsepalum; f, petal; g, lip (longitudinal section); h, column (side view); i, column apex (detail); j, staminode; k, anthers; l, hair from ovary (detail). Drawn by Susanna Stuart-Smith, a–e and h–m from *Hooker & Thomson* 317 (K); c and g from icon. *Cribb* (K).

GENERAL DISTRIBUTION. W China (Xizang, Sichuan, Gansu and Yunnan).
ETYMOLOGY. From the Latin *tibeticus* (from Tibet). However, the collections, cited by R.A. Rolfe in the original description, were from China and Sikkim. None of these localities are now considered to be in Tibet (Xizang).
NOTE. A very variable species, particularly in China and Xizang. The variation may warrant taxonomic recognition, but further field work is needed to assess it.

Section **Bifolia** (Lindl.) S.C. Chen in Proc. 12th World Orchid Conf. Tokyo: 145 (1987).

4. C. guttatum Sw. in Kongl. Vetensk. Acad. Nya. Handl. 21: 215 (1800). Type: Russia, E Siberia, *Gmelin* s.n. (holo. B!, iso. BM! W!).

Cypripedium calceolus var. *δ* L., Sp. Pl. ed.1(2): 951 (1753). Type: E Siberia, *Gmelin*, herb. Pallas (holo. B!, iso. BM!).

C. guttatum var. *tongolensis* Franchet *ined.* in Pradhan in Orchid Digest 50: (1986).

Plant 12–38cm tall; *rhizome* slender, long, creeping. *Stem* pubescent, hollow below the leaves, 1.5–10cm long. *Leaves* up to 2, subopposite up to 2cm apart, ovate-lanceolate, acute to acuminate, glabrous above, pubescent on the veins below, 4.5–12.5 × 2.5–5.5cm. *Inflorescence* 1-flowered; peduncle densely glandular-pubescent, 7–13cm long; floral bract ovate, acute to acuminate, ciliate, 1.5–3.5cm long. *Flower* white, spotted with purple; pedicel and ovary glandular-pubescent, 0.6–1.8cm long. *Dorsal sepal* ovate-elliptic, acute or shortly acuminate, 1.7–2.5 × c.1.4cm; *synsepal* narrowly elliptic, bifid, acute at apex, 1.1–1.5 × 0.5–0.6cm. *Petals* spreading, oblong to subpandurate-spathulate, rounded at apex, 1.3–2 × 0.5–0.8cm. *Lip* urceolate, with a broad mouth, the incurved sides subquadrate, 1.4–2.2 × 1–1.3cm. *Column* 0.5–0.7cm long; staminode ovate, retuse, with upcurved sides, 0.5–0.6 × 0.4–0.5cm. **Plate 1.**

24 **Bhutan:** C – Ha (Ha), Thimphu (Paro to Bela-La) and Tongsa (Taktse) districts; **Chumbi** (Chumbi Valley, Yatung to Trakarpo). In large colonies in grassland and open woodland; 1000–4100m. Fl. May–July.

GENERAL DISTRIBUTION. NW America, W Russia (Urals) to Siberia, Sakhalin, Korea, China (Xizang).
ETYMOLOGY. From the Latin *guttatus* (spotted) in reference to the characteristic spotted pattern on the flower.
NOTES. *C. guttatum* is one of the most widespread species in this genus. It is recognised by its two subopposite leaves and spotted flower with narrowly ovate petals and a distinctive urceolate lip.

Section **Retinerva** (Pfitzer) S.C. Chen in Proc. 12th World Orchid Conf. Tokyo: 145 (1987).

5. C. elegans Rchb. f. in Flora 69: 561 (1886). Type: China, Xizang (Tibet), Kang-me, *King's collector* 54 (holo. K!, iso. W! Herb. no. 13368).

Plant dwarf; *rhizome* creeping, 1–2mm in diameter. *Stem* erect, red-villose, 4–11cm long; basal tubular sheaths 2. *Leaves* 2, opposite, spreading, ovate to oblong-ovate, obtuse, long-ciliate, glossy green above, 3-veined beneath, 2.2–8 × 1.6–6.9cm. *Inflorescence* 1-flowered, erect; peduncle villose, 1.4–4.7cm long; floral bract elliptic-lanceolate, acute, hooded over flower, shortly ciliate, 2–3 × 0.7–0.9cm. *Flower* small; sepals and petals dull claret or bright green with claret veins on inner surface, lip white with 3 longitudinal rows of purple warts in front; pedicel and ovary short, ellipsoid, ciliate on ribs, 4–5mm long. *Dorsal sepal* elliptic-ovate, acute, 1.6–2.1 × 0.5–0.8cm; *synsepal* elliptic, bidentate, 1.6–1.8 × c.0.5cm. *Petals* lanceolate, subacute at apex, 1.6–1.8 × 0.5–0.6cm. *Lip* hemispheric, with a pinched, erect, apical rim, upturned at the apex hiding mouth, c.1.2cm long. *Column* c.3mm long; *staminode* very small, elliptic, rounded at apex, 1.5–2mm long.

Bhutan: C – Thimphu (Barshong, Dotena), Punakha (Tang Chu to Ritang) and Tongsa (Maruthang) districts; **N** – Upper Mangde Chu (Mangde Chu) and Upper Bumthang Chu (Pangotang to Chamka) districts; **Sikkim** (Lachen Valley). At edge of *Abies* forest, on steep slopes, in clearings in bamboo and *Abies* forest, under *Juniperus*, in deep leaf mould on limestone, on wet alpine slopes with *Juniperus* sp. and *Primula sikkimensis*; 2800–4400m. Fl. May–July.

GENERAL DISTRIBUTION. NW India, E Nepal and China (Xizang and Yunnan).
ETYMOLOGY. From the Latin *elegans* (graceful).
NOTES. This is an unobtrusive, dwarf orchid, one of the least showy of the Sino-Himalayan species of *Cypripedium* and it is considered to be endangered in NE India. This is probably due to under-reporting due to its rather insignificant habit and flower.

3. **Paphiopedilum** Pfitzer

Plants terrestrial, occasionally epiphytic or lithophytic, less than 50cm tall, rhizomatous. *Stem* very short. *Leaves* 4–8, distichous, conduplicate, ovate-elliptic, acute, minutely 2- or 3-lobed at apex, coriaceous, green or mottled with darker green. *Inflorescence* 1- to several-flowered, terminal; peduncle terete. *Flowers* showy, rather waxy. *Dorsal sepal* erect, large; lateral sepals united to form a synsepal which is more or less similar to the dorsal sepal. *Petals* spreading, horizontal to pendent. *Lip* saccate; lateral lobes incurved, sometimes auriculate, apical margin usually not incurved. *Column* short, with a fleshy, often shield-shaped staminode at apex; anthers 2; pollinia 2, glutinous; stigma large, ventral, fleshy, shortly stalked, papillose.

The genus *Paphiopedilum* was established in 1886 by Ernst Pfitzer in his *Morphologosche Studien über die Orchideenblüthe*. The genus has been monographed by Cribb (1987, 1998) where a full synonymy can be found. It comprises about 70 species found in India, Myanmar, SE Asia, SW China, Indonesia, the Philippines, New Guinea, and the Solomon Islands.

The pollination syndrome is similar to that of *Cypripedium*. Atwood (1985) reported that some species in Borneo and the Philippines were pollinated by syrphid flies which lay their eggs on the staminode. They usually lay their eggs where there are aphids and are perhaps fooled by the appearance of the staminode in some species. Bänziger (1996) reported a similar phenomenon for *P. villosum* (Lindl.) Stein in Thailand.

TYPE. *Paphiopedilum insigne* (Wall. ex Lindl.) Pfitzer, *typ. cons.*
ETYMOLOGY. Named after Paphos, a town in Cyprus with a temple dedicated to Venus, and the Greek *pedion* (a slipper), a reference to the popular name of Lady's or Venus' slipper orchid.

Key to species

1. Leaves mottled in dark and light green; purple below .... **3. P. venustum**
+ Leaves not mottled; green or green with slight purple spotting below 2

2. Dorsal sepal undulate-ciliate, striped with purple and/or green; petals sigmoid-decurved, upper margin strongly ciliate, white striped with purple and/or green; leaf green beneath **1. P. fairrieanum**

+ Dorsal sepal not undulate-ciliate, with a single central purple stripe; petals falcate-decurved, green with brown central veins, upper margin faintly ciliate; leaf purple spotted beneath **2. P. spicerianum**

Section **Paphiopedilum**

1. **P. fairrieanum** (Lindl.) Stein, Orchid.-Buch: 467 (1892). Type: Ex Bhutan, cult. Fairrie (holo. K!).
Cypripedium fairrieanum Lindl. in Gard. Chron. 1857: 740 (1857).

Plant clump forming, to 27cm tall. *Leaves* 4–8, arranged in a fan on a straight stem, linear-oblong, acute, minutely tridenticulate at apex, margins serrulate towards apex, mid-to dark green, 7.5–28 × 2–3cm. *Inflorescence* 1- (rarely 2-) flowered; peduncle 12–45cm long, slender, light green covered with purplish hairs; floral bract elliptic, obtuse, whitish, purple-pubescent, 1–4 × c.0.8cm wide. *Flowers* small to large, showy; sepals white, veined green and purple, dorsal sepal suffused with purple; lip yellow-green to olive with dark veining; staminode yellow, veined with green and purple in centre; pedicel and ovary purple pubescent, 3.5–6cm long. *Dorsal sepal* elliptic, obtuse, ciliate, apical margins recurved, side margins undulate, 3.4–8 × 2.9–7cm; *synsepal* ovate, obtuse, 2.4–3.5 × 1.7–2.5cm. *Petals* sigmoid-decurved, narrowly oblong, acute, undulate and purple-ciliate on the margins, 4–5 × 0.9–1.5cm. *Lip* deeply slipper-shaped, shortly apiculate and outcurved at apex, 3–4 × 1.6–2.25cm. *Column* short, 6.5–7.5mm long; staminode elliptic, tridentate at apex, up to 7.2–9 × 6.2–7mm; stigma ventral, round, c.4mm across. **Fig. 3**; **Plate 1**.

Bhutan: S – Gaylegphug district (near Surelakha (White, 1909)); **Sikkim** (0.5km from Tinkitam (Pradhan, 1996)); **Chumbi** (Amo Chu Valley (White, 1909)). On outcrops of limestone, on dry, sheltered, grassy (*Ischaemum* sp.) slopes; 1400–2200m. Fl. October–December.

GENERAL DISTRIBUTION. NE India (Assam, Arunachal Pradesh).
ETYMOLOGY. Named after Mr R. Fairrie of Liverpool who cultivated the plant and exhibited it before the Horticultural Society in 1857.
NOTES. *P. fairrieanum* was first described in 1857. Subsequently it all but disappeared from cultivation and became known as 'the lost orchid'—but it was not forgotten. By December 1904 it had become so rare in cultivation that Frederick Sander, who established a famous orchid nursery at St. Albans, England, offered a reward of £1000 for its rediscovery. It was found again in W Bhutan. An account of the history of this plant is found in Cribb (1987).

2. **P. spicerianum** (Rchb. f. ex Masters & T. Moore) Pfitzer in Jahrb. Wiss. Bot. 19: 164 (1888).
Type: India, Assam, cult. Veitch ex Spicer (holo. W!, Herb. no. 5380).
Cypripedium spicerianum Rchb. f. ex Masters & T. Moore in Gard. Chron. n.s. 12: 505 (1879).

Plant sometimes lithophytic, to 20cm tall. *Leaves* 4–5, spreading to pendent, oblong-elliptic, acute to obtuse, apex obliquely bidentate, glossy dark green, spotted with purple towards base, 15–30 × 3.5–6cm. *Inflorescence* 1- (rarely 2-) flowered, 13–35cm long; peduncle terete, slender, erect to suberect-curved, glabrous below, pubescent above, 8–22cm long; floral bract elliptic, acute, 1.8–3cm long. *Flowers* 5.5–7cm across; dorsal sepal white with a central maroon vein and greenish base; synsepal whitish; petals yellow-green with a central purple vein; lip glossy, pale green flushed with brown, veins dark brown; staminode white flushed purple, centre yellow; pedicel and ovary glabrous, purple, 3.5–5.5cm long. *Dorsal sepal* curving forwards, obovate-elliptic, obtuse to retuse, sides recurved, pubescent, 2.7–4.2 × 3.5–5cm; *synsepal* ovate, subacute, 2.7–3.5 × 1.6–2.2cm. *Petals* falcate, linear-tapering, acute, upper margin undulate, 3–3.9 × 0.7–1.3cm. Lip slipper-shaped, 3.5–4.3 × 2.5–3cm; staminode elliptic-obcordate, bluntly apiculate, glabrous, auriculate at base, c.1 × 0.6cm. **Plate 2**.

Bhutan: – (unlocalised (Fowlie, 1970)). On rocky limestone cliffs, in high meadows. Fl. October–December.

GENERAL DISTRIBUTION. NE India (Mizoram to Manipur), NW Myanmar (Shan States) and possibly, in W Yunnan near the Myanmar border.
ETYMOLOGY. Named after Herbert Spicer, who first flowered the plant at Godalming, Surrey, England in 1878.

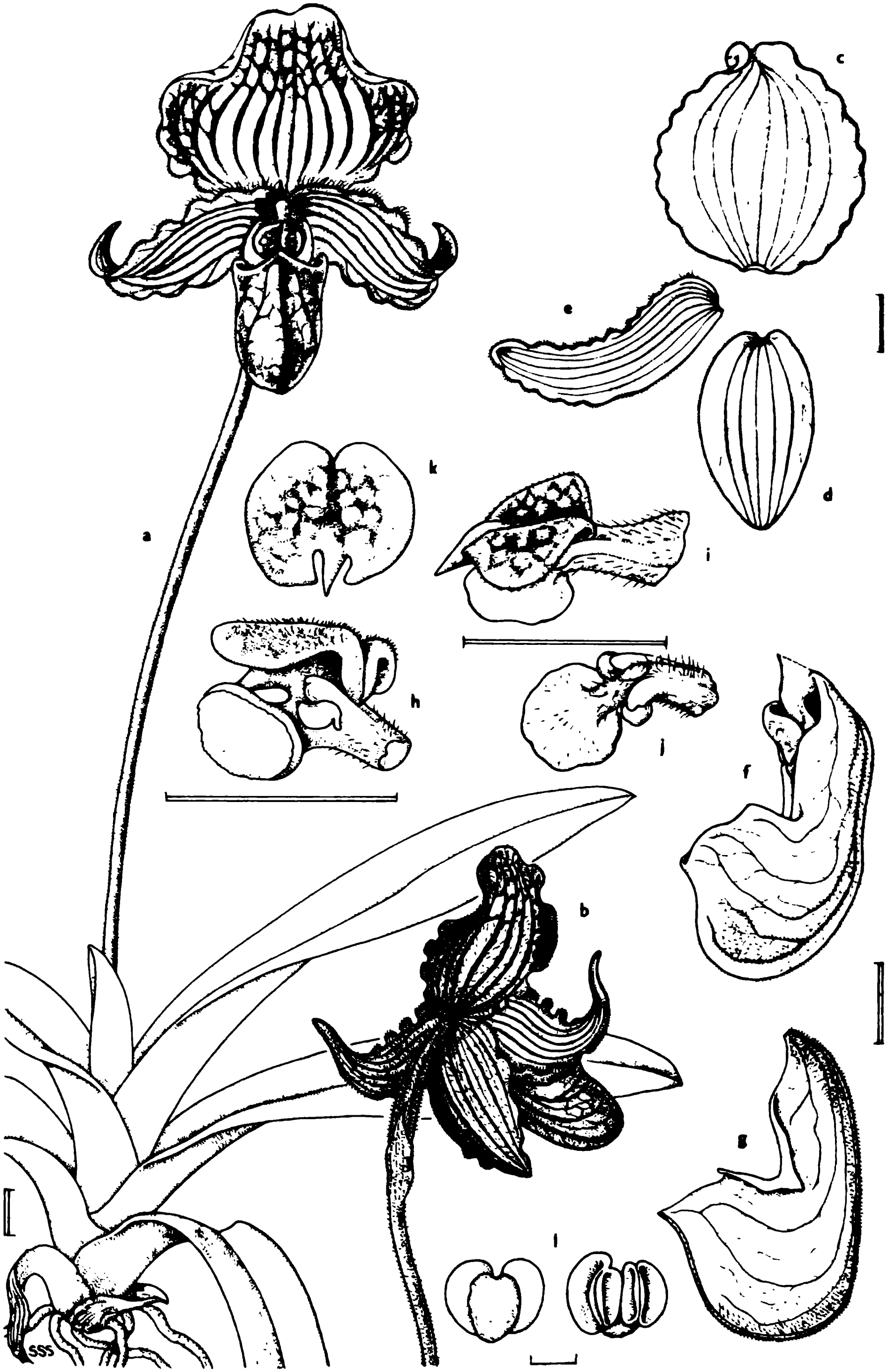


Fig. 3. **Paphiopedalum farrieanum**: a, habit; b, flower (back view); c, dorsal sepal; d, synsepalum; e, petal; f, lip; g, lip (longitudinal section); h, column; i, column; j, column (detail); k, staminode; l, anther (two views). Drawn by Susanna Stuart-Smith from *Gower* 1895 (K) and photographs.

NOTE. *P. spicerianum* was reported from Bhutan by Fowlie (1970) but the locality has been overcollected and the species is now possibly extinct there.

Section **Barbata** Kränzlin, Orchid. 1: 53 (1897).

3. **P. venustum** (Wall.) Pfitzer ex Stein, Orchid.-Buch: 489 (1892). Type: Bangladesh, Sylhet, coll. *F. De Silva* Wall. Cat. 7023 (holo. K-LINDL!, iso. K-W!).
Cypripedium venustum Wall. in Bot. Mag. 47: t.2129 (1820).

Plant to 40cm tall. *Leaves* 4–5, elliptic to oblong-elliptic, tricuspidate at obtuse apex, mottled dark green and grey-green, purple spotted below, ciliate at apex, 10–25 × 3–5.5cm. *Inflorescence* 1- (rarely 2-) flowered; peduncle 10–23cm long, purple, hirsute; floral bract elliptic-lanceolate, acute, sparsely pubescent, 1.7–2.5cm long. *Flowers* 8–9cm across; sepals and petals white with green veins; petals purple flushed in apical half with a few maroon-black warts; lip yellow, tinged purple with green veins; pedicel and ovary shortly pubescent, green spotted with purple, 4–5.9cm long. *Dorsal sepal* ovate, acute, hirsute on outer surface, 3–3.8 × 2.3–2.8cm; *synsepal* similar, 2.4–3 × 1.4–1.7cm. *Petals* recurved, oblanceolate, subacute to obtuse, ciliate, 4.3–5.4 × 1.2–1.4cm. Lip slipper-shaped, lateral lobes warty, 3.3–4.3 × 2.5–3.2cm; staminode reniform, pubescent, 0.7–0.9 × 1–1.1cm. Fruit ovoid, ridged, c.4 × 1.3cm. **Plate 2.**

Darjeeling (Gohsh?); **Sikkim** (Gorh). In tropical valleys. Fl. March–May.

GENERAL DISTRIBUTION. E Nepal, NE India (Khasia, Meghalaya), Bangladesh and China.
ETYMOLOGY. From the Latin *venustus* (beautiful, graceful).
NOTE. *P. venustum* was the first species in the genus to be described and introduced into cultivation by Nathaniel Wallich in 1820 from Sylhet (Bangladesh).

PRIMITIVE ORCHIDS WITH A SINGLE FERTILE ANTHER

Tribe **Gastrodieae** Lindl.

Subtribe **Gastrodiinae** Lindl.

4. **Didymoplexis** Griff.

Plants terrestrial, mycotrophic, leafless, with branched tuberous rhizomes. *Inflorescence* racemose, erect. *Flowers* small; pedicels elongate. *Dorsal sepal* and *petals* adnate, forming a single trifid segment; lateral sepals connate, forming a shallow cup or tube with the dorsal sepal and petals. Lip adnate to the column foot, entire. *Column* elongate, slender, 2-winged above, with a short foot basally; clinandrium entire, with elevated margins; anther inclined; pollinia 2, granular; rostellum short; stigma broad.

The genus *Didymoplexis* was established in 1844 by William Griffith in the *Calcutta Journal of Natural History*. The genus comprises about 20 species distributed in tropical Africa, Madagascar, Asia, Malaysia and the adjacent islands.

The pollination mechanism in this genus is unknown, but some species are probably self-pollinating.

TYPE. **Didymoplexis pallens** Griff.
ETYMOLOGY. From the Greek *didymo-* (double, twofold) and *plectos* (plaited, twined) in reference to the adnation of the petals with the dorsal sepal forming a single 3-lobed structure.

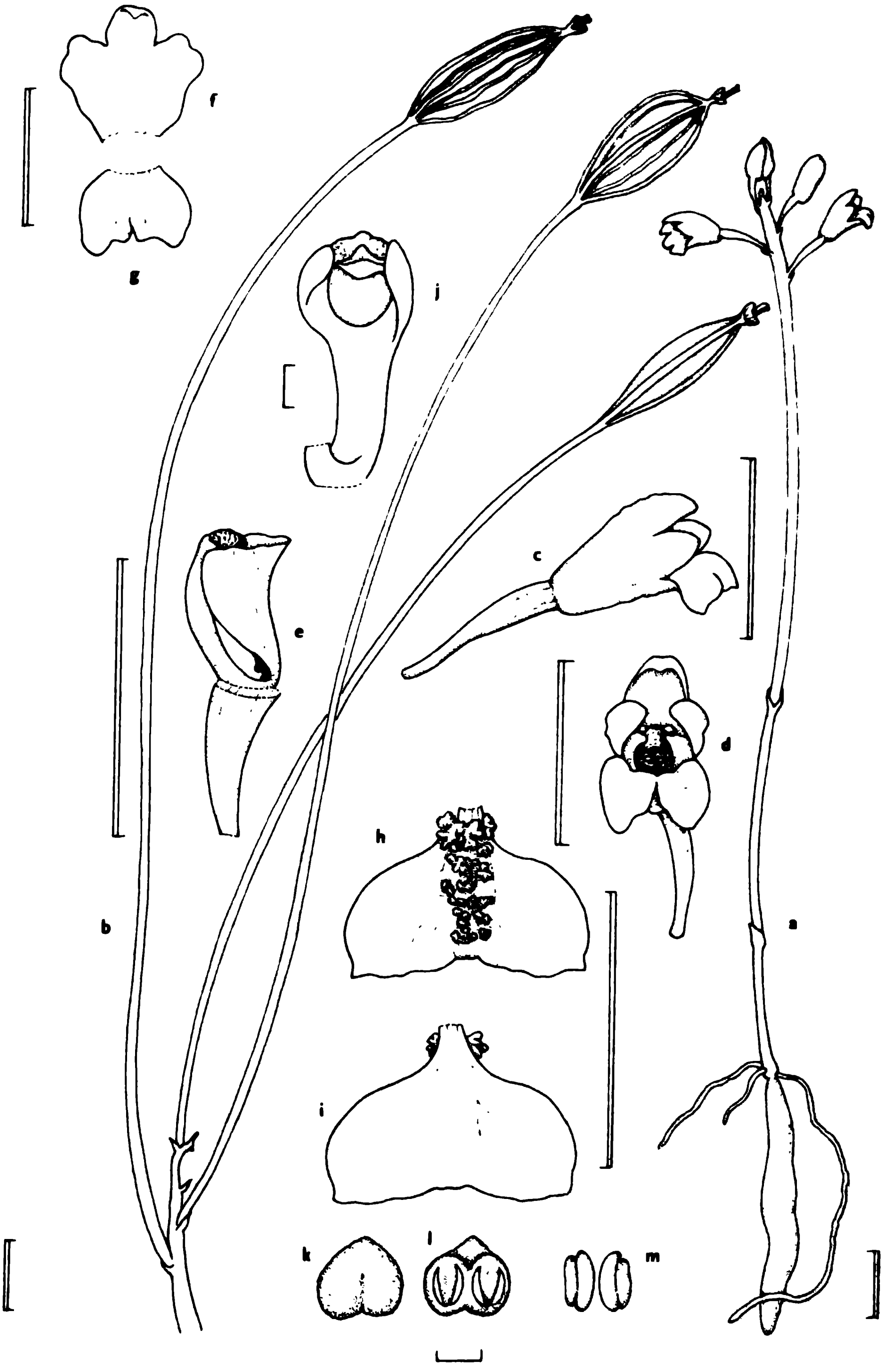


Fig. 4. **Didymoplexis pallens**: a, habit (with inflorescence); b, infructescence; c, flower (side view); d, flower (front view); e, column, lip and ovary; f, dorsal sepal and petals; g, lateral sepals; h, lip (front view); i, lip (back view); j, column; k, anther (back view); l, anther (front view); m, pollinia. Drawn by Susanna Stuart-Smith, a, c–g, k–m from Hort. Kew 1903 (K); b from *Clarke* 11867 (K); h–j from *Hooker* 1867 (K).

1. D. pallens Griff. in Calcutta J. Nat. Hist. 4: 383, t.17 (1844). Type: India, Serampur, local collector s.n. (holo. CAL!).

Leucorchis sylvatica Bl., Mus. Bot. 1: 31 (1849). Type from Java.
Arethusa ecristata Griff., Not. Pl. Asiat. 3: 378 (1851). Type from Afghanistan.
Apetalon minutum Wight, Icon. Pl. Ind. Orient. 5: t.1758 (1852). Type: India, Coorg, *Jerdon* s.n. (holo. K!).
Epiphanes pallens (Griff.) Rchb. f. in Seemann, Fl. Vit.: 296 (1868).
Gastrodia pallens (Griff.) F. Mueller, Contr. Phytogr. New Hebrides: 22 (1870).
Arethusa bengalensis Hort. ex Hemsley in J. Linn. Soc., Bot. 20: 311 (1884), nom. nud.
Didymoplexis subcampanulata Hayata, Icon. Pl. Formos. 2: 136 (1912). Type from Taiwan.
Cheirostylus kanarensis Blatter & McCann in J. Bombay Nat. Hist. Soc. 35: 732, f.4 (1932). Type: India, N Kanara, Tatwal, T.R. Bell (holo. BLAT).
Didymoplexis brevipes Ohwi in Acta Phytotax. Geobot. 6: 238 (1937). Type from Japan.

Plant 11–32cm tall; *tubers* fusiform, often moniliform, 1.5–3.7 × 0.5–0.6cm. *Stem* erect, leafless, slender, ridged, glabrous, distantly 1- to 3-sheathed, 12–25cm tall, pale buff-coloured; sheaths tubular, acute, 2.2–3.6mm long. *Inflorescence* laxly few-flowered; floral bracts minute, ovate, acuminate, 2–3 × 1–1.8mm. *Flowers* opening in succession, campanulate, bilabiate, 0.4–1cm long; uniformly white with a yellow tinge on the lip, ovaries brown; pedicel and ovary short, 4–9.5mm long. *Lateral sepals* connate, with free portion reflexed, 2-lobed, lobes obtuse and rounded, 6–7 × 6–7mm (at widest point); sepaline tube short, c.3mm long; *dorsal sepal* adnate to *petals* forming a hood, free portion 3-lobed, each lobe ovate-deltoid, 0.6–0.9 × 1cm (at widest point). *Lip* deltoid, truncate in front, erose-crenate, base cuneate, 5–6 × 6–9mm; disc with numerous small, stipitate-warty papillae. *Column* curved, clavate, apex 2-winged, 5–6mm long; anther cap c.1.9 × 1.8mm; pollinia 2, cleft. *Fruit* 2–3 × 0.4–0.6cm. **Fig. 4.**

Darjeeling (12km S of Kalimpong, Sureil); **Sikkim** (unlocalised *Pantling* specimen). Found growing under bamboo, on cultivated land; 300–2000m. Fl. April–May.

GENERAL DISTRIBUTION. Afghanistan, NE India, Thailand, Japan, Malaysia to the Philippines, New Guinea and Australia.
ETYMOLOGY. From the Latin *pallens* (pale) in reference to the flower colour.

5. Gastrodia R. Br.

Plants terrestrial, mycotrophic, leafless, lacking chlorophyll; rhizomes tuberous. *Inflorescence* terminal, erect, laxly racemose. *Sepals* and *petals* united into a ventricose tube, with a 5-lobed apex in front between the lateral sepals, which are shortly, or extensively, connate. Lip adnate to the column foot, spurless. *Column* more or less elongate, rarely short, slender with a short foot; anther incumbent; pollinia 2, granulose; stigma at base of column.

The genus *Gastrodia* was established in 1810 by Robert Brown in his *Prodromus Florae Novae Hollandiae*. The genus comprises about 20 species distributed from India and E Asia, through Malaysia to Australia and New Zealand.

Jones (1981) has reported pollination in *G. sesamoides* R. Br. by small xylocopid bees (genus *Exoneura*) that gather pseudopollen from the lip.

TYPE. *Gastrodia sesamoides* R. Br.
ETYMOLOGY. From the Greek *gastris* (pot-bellied) in reference to the shape of the urceolate sepals which are inflated at the base in front.

Key to species

1. Inflorescence with up to 9 flowers; stem usually less than 40cm tall; floral bracts less than 0.15cm long .... **1. G. dyeriana**
+ Inflorescence with 8–32 flowers; stem usually more than 40cm tall; floral bracts more than 1cm long .... **2. G. elata**

1. G. dyeriana King & *Pantling* in J. Asiat. Soc. Bengal 64(3): 342 (1896). Type: India, Sikkim, *Pantling* 293 (holo. CAL, iso. BM! K! W!).

Plant to 40cm tall; *rhizome* short, horizontal, with slender spreading roots, twice as thick as the stem. *Stem* ridged, sheathed, glabrous, 30–40cm long; sheaths few, appressed, lanceolate, acute, distant, 0.6–1.1cm long. *Inflorescence* laxly 3- to 9-flowered, near apex of stem; floral bracts short, triangular, 1–1.5mm long. *Flowers* pendent, 1–1.5cm long; brownish; pedicel and ovary curved, 3–4mm long. *Sepals* similar, united to form a sepaline tube, entire, 0.7–1 × 0.6–0.7cm (when spread); sepaline tube cylindric, glabrous, 7- to 8-veined, mouth 3-lobed. *Petals* small, inserted at apex of sepaline tube, ovate-orbicular, subacute, entire, 1-veined, c.1.5 × 1mm. *Lip* equalling the column, shorter than the sepaline tube, ovate-lanceolate, clawed, flat, edges undulate-crenulate, with 3–4 parallel, thickened lines from the base to the tip, 5.5–9 × 2–2.2mm; claw short, with 2 subglobose, raised calluses, c.0.6mm across. *Column* slender, with winged sides, apex truncate and 4-toothed, 5–5.3mm long; foot short, c.1.8mm long; anther cap c.0.8 × 0.5mm; pollinia narrowly ovoid, c.0.75mm long. **Fig. 5; Plate 2.**

Darjeeling (Budhwari); **Sikkim** (unlocalised *Pantling* specimen). In evergreen oak forest in leaf mould, at wood edges; 1500–2200m. Fl. August.

GENERAL DISTRIBUTION. Nepal.

ETYMOLOGY. Named after Sir William Thiselton-Dyer (1843–1928), Director of the Royal Botanic Gardens Kew from 1885 until 1905.

2. G. elata Bl., Mus. Bot. 2: 174 (1856). Type: Japan, Ten-ma, *Burger* s.n. (holo. L! Herb. no. 9023222263).

Gastrodia mairei Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 12: 105 (1913). Type: China, Yunnan, Long-Ky, *Maire* 13 (holo. B).

G. elata var. *gracilis* Pampanini in Nuovo Giorn. Bot. Ital. s.n. 22: 271 (1915). Type: China, Hupei, *Silvestre* 4055 (holo. FI).

G. elata f. *pilifera* Tuyama in J. Jap. Bot. 17: 582 (1941). Type from Taiwan.

Plant up to 1.2m tall; *rhizome* tuberous, ridged, 1.5–2cm thick. *Stem* erect, ridged, glabrous, up to 70cm tall and 6mm wide; sheathing bracts to 3, 1.5–2.4cm long. *Inflorescence* laxly 8- to 32-flowered; rachis 12–24cm long, floral bracts lanceolate, long acuminate, 1–1.5cm long. *Flowers* fleshy, semi-open, c.1cm across; sepals and petals pale yellowish-green, edged with pale brown, lip and column white, ovary brown; pedicel and ovary short, clavate, 5–7mm long. *Sepals* subequal, elliptic-lanceolate, acute to apiculate, adnate to the petals, 0.6–1cm long. *Petals* similar to sepals, acute, 0.6–1cm long. *Lip* obscurely 3-lobed, clawed, base with 2 gibbous foldings, ovate-oblong, apical margins with thick fimbriae; disc with a reniform callus on both sides, 5–6mm long. *Column* curved, 3–4mm long. *Fruit* ovoid, 1–1.7 × 0.5–1cm.

Bhutan: C – Thimphu (Dzato La) and Bumthang (Bumthang, Lami Gompa) districts; **Sikkim** (Lachung); **Chumbi** (Phari Dzong). In shady *Pinus wallichiana* forest; 2000–4000m. Fl. (June–)August–September.

GENERAL DISTRIBUTION. NE India, China, Taiwan and Japan.

ETYMOLOGY. From the Latin *elatus* (tall).

NOTES. In habitat, inflorescence and flowers this plant closely resembles *G. falconeri* D.L. Jones & M.A. Clements (syn.: *G. orobanchoides* (Falconer) Bentham, non F. Mueller 1873) from the NW Himalaya. Hooker (1890) examined the Chumbi specimens, compared them with material from Japan, and concluded that the almost reniform callus on each side of the lip separated it from *G. orobanchoides* which had two thickened lines on the callus.

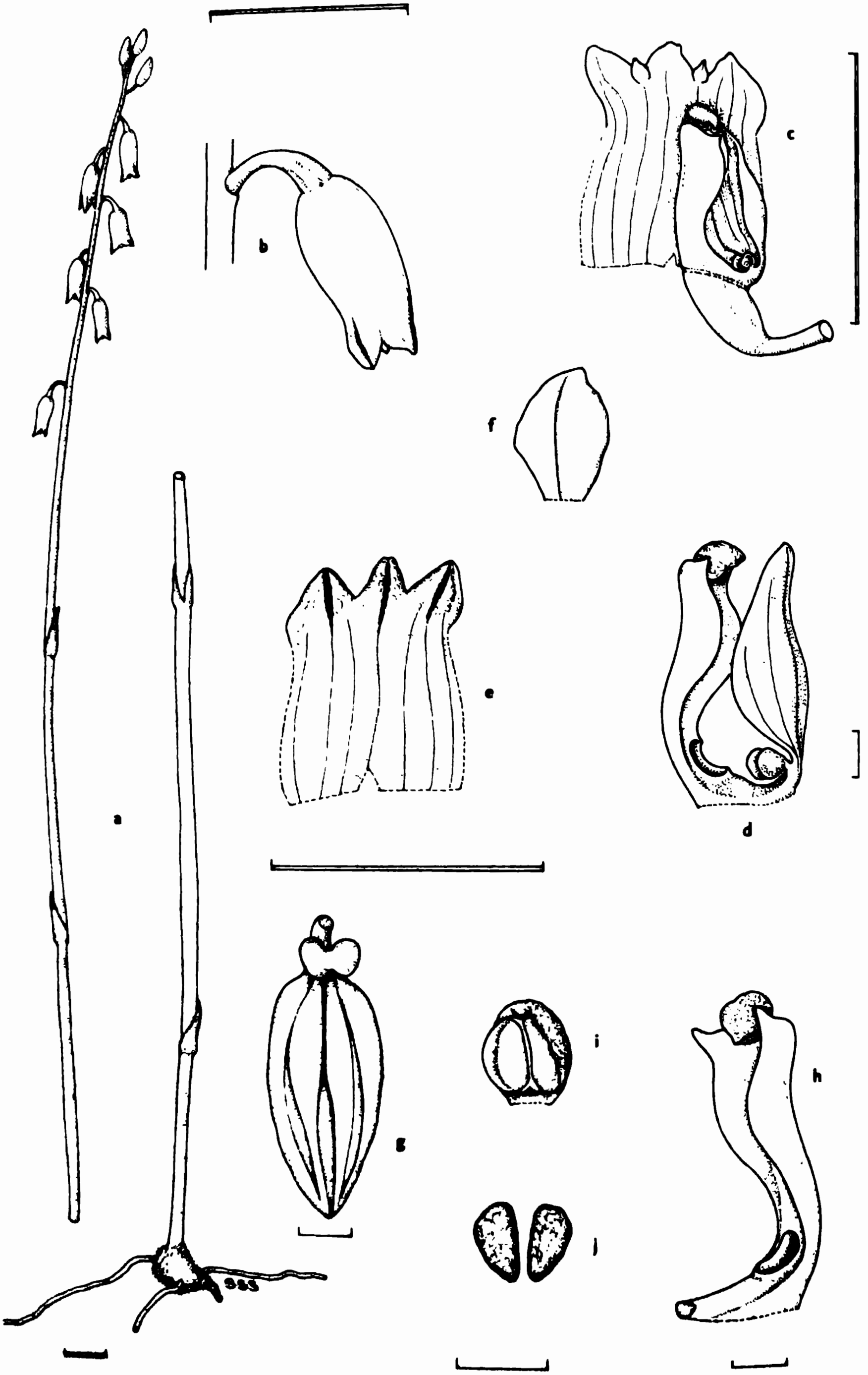


Fig. 5. ***Gastrodia dyeriana***: a, habit; b, flower; c, sepals, petals, lip and column (opened out); d, column and lip; e, sepals (opened out); f, petal; g, lip; h, column; i, anther; j, pollinia. Drawn by Susanna Stuart-Smith, a from *Pantling* 293 (K); b–j from *Kingdon-Ward* 8533 (K).

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

G. **mishmensis** A.N. Rao, Haridasan & Hegde in Arunachal Forest News 9(1): 10 (1991). Type: India, Arunachal Pradesh, Lohit district, Melinja, *Haridasan* 3529 (holo. Arunachal Forest Herbarium, Chessa).

NOTES. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh. We have seen no material of this species; it is clearly close to G. *elata*, and possibly conspecific.

Subtribe **Epipogiinae** Schltr.

6. **Epipogium** S.G. Gmelin ex Borkhausen

Plants mycotrophic, leafless, lacking chlorophyll; *roots* coralloid or tuberous. *Inflorescence* few-flowered, racemose. *Flowers* more or less pendent. *Sepals* and *petals* similar, free, connivent or spreading. *Lip* sessile, fleshy, basally produced into a distinct spur; disc papillose to pilose. *Column* short; clinandrium membranous; anther more or less incumbent, dorsally fleshy; pollinia 2, granulose; stigma distant from the short, broad rostellum.

The genus *Epipogium* was established (as *Epipogum*) in 1747 by S.G. Gmelin in his *Flora Sibirica*. Since the original description, there have been no less than four different published spellings for the genus, causing a confusion that was reviewed by Sprague & Green (1937). Most authors have since used *Epipogium*, the earliest use of which was in 1792 by Moriz Balthasar Borkhausen in his *Tentamen Dispositionis Plantarum Germaniae*. The genus comprises about five species, widely distributed in Eurasia, tropical Africa, India, Malaysia and the Malay Archipelago.

Rao (1987) reviewed the genus and proposed a sectional treatment (sections *Epipogium* and *Roseum*) based upon the gynostemium structure. We do not follow this treatment here because the small number of species does not justify it.

In most populations pollination is usually autogamous and Jones (1985a) explained the mechanism for E. *roseum*. Rohrbach (1866) reported that E. *aphyllum* was visited by the bumble-bee *Bombus lucorum*, which might pollinate it, but van der Pijl & Dodson (1966) were sceptical that this was the case.

TYPE. *Satyrium epipogium* L.
ETYMOLOGY. From the Greek *epi* (upon) and *pogon* (a beard) in reference to the bearded or papillose appearance of the disc on the lip.

Key to species

1. Spur equalling the lip and ovary; lip non-resupinate (uppermost); rhizome coralloid, branched **1. E. aphyllum**
+ Spur much shorter than the lip and ovary; lip resupinate (lowermost); rhizome tuberous **2. E. roseum**

1. E. **aphyllum** Sw., Summa Veg. Scand.: 32 (1814). Lectotype: based on Gmelin, Fl. Sibir. 1: 11, t.2, f.2 (1747)! designated by Renz & Taubenheim in Davis, Fl. Turkey 8: 470 (1984).
Satyrium epipogium L., Sp. Pl.: 945 (1753). Type from Russia.
Orchis aphylla sensu F.W. Schmidt in Samml. Phys. Aufsätze Böhm Naturgesch. 1: 240 (1791), non Forsskål (1775).
Limodorum epipogium (L.) Sw. in Nov. Acta Regiae Soc. Sci. Upsal. 6: 80, t.5 (1799).
Epipogium gmelinii L.C. Richard, De Orchid. Eur.: 36 (1817), nom. nud.
E. *aphyllum* var. *stenochilum* Handel-Mazzetti, Akad. Wiss. Wien. 3(Dec.): 8 (1925); Symb. Sin.: 1343 (1929–36). Type: China, Yunnan, *Handel-Mazzetti* 10038 (holo. WU, iso. W!).

Plant up to 20cm tall; *rhizome* coralloid, branching, bearing scale-like leaves. 1.5–2.5 × 1–1.8cm. *Stem* stout, somewhat swollen at base, 10–26cm long; sheaths 2, basal, unequal, brown, 0.7–1.2cm long. *Inflorescence* 1- to 8-flowered; rachis 5–11cm long; floral bracts ovate, acuminate, membranous, 0.9–1.2 × 0.3–0.5cm. *Flowers* non-resupinate, pendent, shortly stalked, c.2cm across; sepals and petals faintly yellowish to reddish, lip whitish-yellow with red streaks on the spur; pedicel and ovary slender, 5–7mm long. *Sepals* and *petals* similar, narrowly oblong, subacute, 0.8–1.5cm long. Lip 3-lobed, 6–9mm long; hypochile with 2 broadly triangular lateral lobes; epichile deflexed, cordate, acute, concave, upper surface with 4–6 rows of parallel papillose lamellae; *spur* thick, blunt, dorsally flattened, 3–5mm long. Column stout, curved, 5–6mm long; stigma large. Fruit ovoid, c.1 × 0.6cm.

Bhutan: C – Thimphu (above Dotena near Barshong) and Bumthang (near Bumthang) districts; N – Upper Mo Chu (near Laya) and Upper Pho Chu (Wachhey) districts; **Sikkim** (Lachung Valley). In shady woods, especially in the montane zone, in bamboo thickets and *Abies/Quercus* forest; 2500–3500m. Fl. July–September.

GENERAL DISTRIBUTION. Europe, the Near East, Russia (Caucasus to Kamtschatka), east through temperate Asia to Japan, Korea and the Himalayas.
ETYMOLOGY. From the Greek *a-* (without) and *phyllon* (leaf).
NOTES. Handel-Mazzetti described *E. aphyllum* var. *stenochilum* based upon a collection he had made in Yunnan. We have examined a number of plants from the Himalayas and China and there is considerable variation in both the plant habit and the lip shape and size. We consider that the narrow lipped variety should be included within the synonymy of *E. aphyllum* and that it probably represents a peloric form.

Rao (1987) considered the gynostemium in this section to be related to *Didymoplexis* and *Gastrodia*.

2. **E. roseum** (D. Don) Lindl. in J. Proc. Linn. Soc., Bot. 1: 177 (1857). Type: Nepal, *Wallich* s.n. (holo. BM!).
Limodorum roseum D. Don, Prodr. Fl. Nepal: 30 (1825).

Ceratopsis rosea (D. Don) Lindl., Gen. Sp. Orchid Pl.: 384 (1840).
Podanthera pallida Wight, Icon. Pl. Ind. Orient. 5: t.1759 (1852). Type: India, Wynaud, *Jerdon* (holo. K-LINDL!).
?*Epipogium tuberosum* Duthie in Ann. Roy. Bot. Gard. (Calcutta) 9(2): 151 (1906). Type: Kashmir, Sind Valley, *Clarke* 31230 (syn. K!); Liddar Valley, *Duthie's collector* 25386 (syn. K!).
E. sinicum Tso in Sunyatsenia 1(2–3): 132 (1933). Type: China, Kwangtung, *H.Y. Liang* 61675 (holo. SYS).

Plant up to 50cm tall; *rhizome* tuberous, of many internodes, 2–3 × 1–1.7cm. *Stem* erect, glabrous, sheathed, 10–25cm tall; sheaths broadly ovate, 1–1.5cm long. *Inflorescence* pale pink, laxly several-flowered; rachis suberect to pendent, 6–12cm long; floral bracts ovate-elliptic, acute, 0.9–1.2 × 0.3–0.4cm. *Flowers* resupinate, variable, pendent, pale pink to pale yellow with a few purplish-brown to pink markings and spots; pedicel and ovary c.8mm long. *Sepals* gaping, lanceolate, acute, undulate, 3-veined, 1.1–1.2 × 0.25–0.26cm. *Petals* narrowly ovate-lanceolate, acute, slightly undulate, 3-veined, 0.9–1 × 0.2–0.35cm. *Lip* spurred, 1–1.2 × 0.8–1cm (when spread); blade cordate-ovate, sides upcurved, margins erose-denticulate; disc with 2, long, outer papillose ridges and a central, shorter ridge; *spur* 3.5–4.5 × 3–3.5mm long. *Column* stout, 2.8–4mm long; pollinia 0.1–0.2mm long. *Fruit* ovoid-ellipsoid, 5–7 × 3–4mm. **Fig. 6.**

Darjeeling (Rambi); **Sikkim** (Tista River, Rimbi Chhu). In damp rain forest, in decaying vegetation, often flowering after heavy rainfall in the summer; 200–2000m. Fl. (February–)May–July(–October).

GENERAL DISTRIBUTION. Africa, Nepal, NE India, China, tropical Asia, Japan, Malaysia, the Philippines and Australasia.
ETYMOLOGY. From the Latin *roseus* (rose-coloured).
NOTES. Tuyama (1967) published a detailed review of *E. roseum* in Japan and adjacent regions, and Garay & Sweet (1974) provided an extended synonymy. Deva & Naithani (1986) considered that *E.*

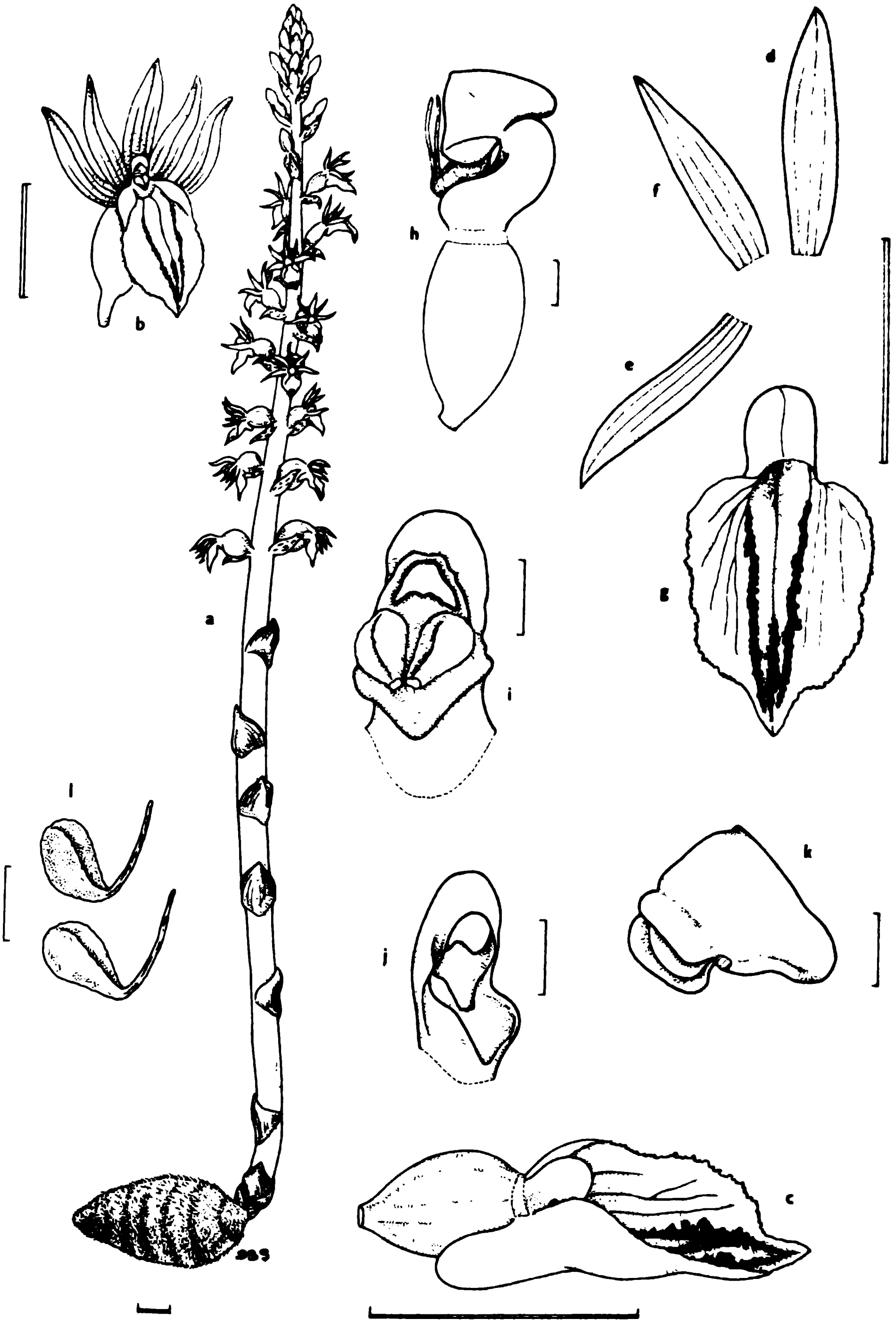


Fig. 6. **Epipogium roseum**: a, habit; b, flower; c, column and lip (side view); d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column and ovary (side view); i, column apex; j, column apex (with anther and pollinia removed); k, anther cap; l, pollinaria. Drawn by Susanna Stuart-Smith from *Garstead* 2142 (K).

tuberosum Duthie was a distinct species found at altitudes of over 2500 m, and with a fewer-flowered inflorescence; we here include it within the synoymy of *E. roseum*, but with a question mark.

Rao (1987) considered the gynostemium structure to be related to *Goodyera* and *Hetaeria*.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

E. sessanum Hegde & A.N. Rao in J. Econ. Taxon. Bot. 3(2): 598 (1982). Type: India, Arunachal Pradesh, W Kameng district, Sessa, *Hegde* 3800 (holo. Orchid Herbarium Tipi).

NOTES. This recently described species can be distinguished from the other species in that it lacks a spur and the disc on the lip lacks any warty lines; it may possibly represent a peloric form of *E. roseum*. It flowers in May and June and is considered to be endangered (Hegde & Rao, 1983b).

Tribe **Neottieae** Lindl.

Subtribe **Limodorinae** Bentham

7. **Aphyllorchis** Bl.

Plants terrestrial, leafless, mycotrophic; *rhizome* short with slender or thick spreading fibrous roots. *Stem* sheathed. *Inflorescence* terminal, erect, laxly racemose. *Flowers* small to medium-sized. *Sepals* and *petals* similar, free, more or less spreading. *Lip* sessile or shortly clawed, entire or obscurely lobed, the base with a pair of auricles. *Column* slender, lacking a foot; anther 2-celled, dorsal; stigma under rostellum, short, ovate; pollinia 2, mealy.

The genus *Aphyllorchis* was established in 1849 by the Dutch botanist, Carl Ludwig Blume in his *Museum Botanicum Lugduno-Batavum*. The genus comprises about 33 species distributed from the Himalayas, SE Asia, south through the Malay Archipelago to Queensland.

Aphyllorchis is a genus of mycotrophic orchids members of which are usually self-pollinated. Chen & Tsi (1987) suggested that *Tangtsinia* S.C. Chen (Chen, 1965, now transferred to *Cephalanthera*), *Sinorchis* S.C. Chen (Chen, 1978) and other primitive groups related to *Aphyllorchis*, *Cephalanthera* and *Neottia* could represent peloric forms of those genera. Peloria is a type of floral abnormality found in many zygomorphic-flowered taxa and has been considered as a reversal in which the lip becomes similar to the petals. Dressler (1993) considered that these self-pollinating forms are 'reversions' that are viable because of self-pollination.

TYPE. *Aphyllorchis pallida* Bl.
ETYMOLOGY. From the Greek *a*- (without), *phyllon* (leaf) and *orchis* (testicle, a term used to describe orchids based on the root shape).

Key to species

1. Plant robust; stem thick; flowers more than 1.5cm long; ovary 3–8mm wide .... **1. A. alpina**
+ Plant slender; stem slender; flowers less than 1cm long; ovary less than 3mm wide **2. A. montana**

1. A. alpina King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 261, t.347 (1898). Types: India, Sikkim, Singalila, *Pantling* 462 (syn. CAL, isosyn. BM! K! W!); Sikkim, Mon Lepcha?, *King's collector* 4459 (syn. W not found).

Plant up to 80cm tall; *rhizome* elongate, covered with scales. *Stem* thick, terete, covered by up to 8 tubular sheaths; sheaths 2.5–4cm long. *Inflorescence* 8- to 11-flowered; rachis puberulent, 10–21cm long; floral bracts linear-lanceolate, acuminate, deflexed, 2–3 × 0.3–0.5cm. *Flowers* campanulate, 1.5–2 ×

1.3–1.8cm; pedicel and ovary stout, cylindric, puberulous, 2–3 × 0.3–0.8cm. *Sepals* subequal, lanceolate, acuminate, concave, spreading, reflexed at apex, 1.6–2 × 0.5–0.6cm. *Petals* smaller than the sepals, ovate-lanceolate, midrib thickened, c.1.5cm long. *Lip* clawed, 1.5–2cm long; claw winged and adnate to sides of the column; mid-lobe with erect, rounded sides. *Column* stout, curved; stigmas with overlapping, irregular lobulate margin, c.9mm long; anther 2-celled; pollinia mealy. *Fruit* ovoid, shortly stalked, 2.5–3 × 06–0.8cm.

Darjeeling (Budhwari to Bhotia Basti, Ramman); **Sikkim** (Bakhim to Prek Chhu, Mon Lapcha, Singalila Range). In *Tsuga* and *Rhododendron* forests; 2100–3900m. Fl. July–August; Fr. August.

GENERAL DISTRIBUTION. NE India and China.
ETYMOLOGY. From the Latin *alpinus* (growing in the alpine zone).

2. **A. montana** Rchb. f. in Linnaea 41: 57 (1877). Type: Sri Lanka (Ceylon), Ambagumowa district, *Thwaites* 3189 (holo. K!, iso. BM!).
Apaturia montana sensu Thwaites, Enum. Pl. Zeyl.: 301 (1861), *non* Lindl. (1831).
Aphyllorchis prainii Hook. f., Fl. Brit. India 6(1): 117 (1890). Type: India, Naga Hills, *Prain* 68 (holo. K!).
A. benguetensis Ames, Orchidaceae 2: 49 (1908). Type from the Philippines
A. tanegashimensis Hayata in J. Coll. Sci. Imp. Univ. Tokyo 30(1): 344 (1911). Type from Japan.
A. unguiculata Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 415 (1925). Type from Thailand.
A. purpurea Fukuyama in Bot. Mag. (Tokyo) 48: 431 (1934). Type from Taiwan.

Plant up to 80cm tall; *rhizome* fleshy. *Stem* erect, purplish, lower half covered with 3–4 distinct scale-like sheaths of up to 6cm long. *Inflorescence* laxly up to 15-flowered; floral bracts linear-lanceolate, acute, c.1.2 × 0.3cm wide. *Flowers* small, up to 8mm long; pale purple-brown; pedicel and ovary slender, glabrous, 1.5–2 × c.0.2cm wide. *Sepals* oblong-elliptic, subacute, spreading with revolute margins, 3-veined, 0.9–1 × 0.2–0.3cm. *Petals* oblong-elliptic, subacute, 3-veined, c.1 × 0.2cm. *Lip* more or less fleshy, shortly clawed, obscurely 3-lobed, 5–8 × 4–5mm; claw with a small triangular auricle on both sides; lateral lobes erect, rounded; mid-lobe obovate to rhombic, tapering to an obtuse apex with a minutely erose margin; disc minutely warty. *Column* curved, cylindric, 6–8mm long. **Fig. 7k–s.**

Darjeeling (unlocalised *Griffith* specimen); **Sikkim** (Sherabthang). In deep broad-leaved forest, on forest floor; 600–2800m. Fl. June–August.

GENERAL DISTRIBUTION. Sri Lanka, NE India, China, SE Asia, Japan, the Philippines and Malaysia.
ETYMOLOGY. From the Latin *montanus* (of mountains).

8. Cephalanthera L.C. Richard

Plants terrestrial; roots numerous, fibrous. *Stem* erect, leafy. *Leaves* sessile, plicate. *Inflorescence* terminal, racemose, laxly- to ± densely flowered. *Flowers* suberect, white, pink or yellow; ovary sessile. *Sepals* and *petals* subsimilar, free, connivent. *Lip* 2-lobed, adnate to column base; hypochile concave to saccate; epichile recurved, with longitudinal ridges. *Column* long, erect; stigma large; rostellum short to absent; anther hinged; pollinia 2, clavate, mealy. *Fruit* erect.

The genus *Cephalanthera* was established in 1818 by the French botanist, Louis Claude Richard in the *Mémoires du Muséum d'Histoire Naturelle, Paris*. The genus comprises about 15 species distributed through N America, Europe and northern Asia.

The flowers of *Cephalanthera* offer no nectar and there is evidence that they may mimic other flowers. Dafni & Ivri (1981) showed that, in Israel, solitary bees of the genus *Halictus*, were found to be effective pollinators of *C. longifolia*. The flower offers no reward to the insect, but the orange papillae on the lip successfully mimic the pollen of *Cistus salvifolius*. The *Halictus* bee therefore mistakes the *Cephalanthera* for its normal food plant and acts as a pollinator. As the plant also attracts pollinators in the absence of *Cistus* this is regarded as facultative floral mimicry. Nilsson (1983a) found that, in

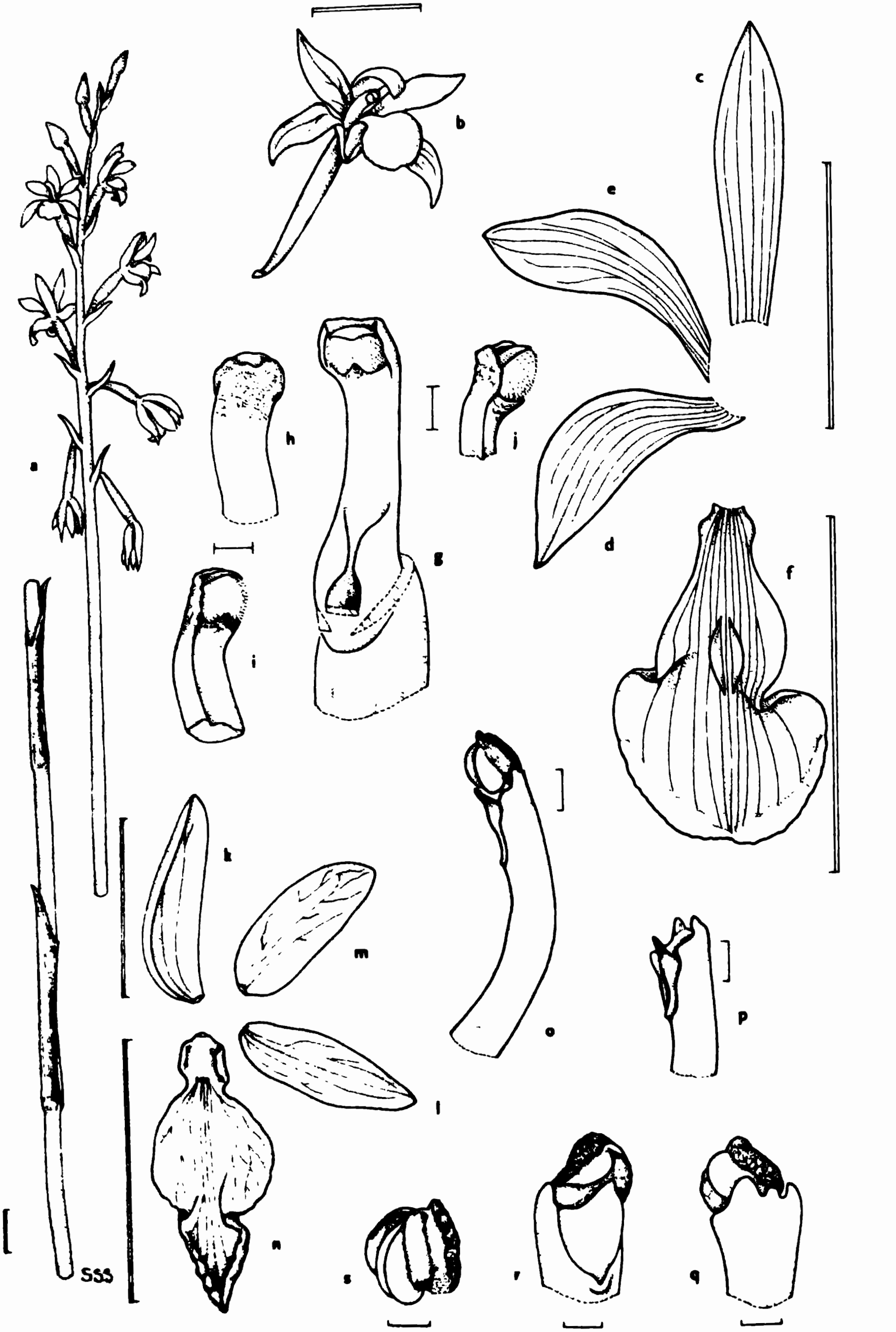


Fig. 7. **Oreorchis sanguinea**: a, habit; b, flower; c, dorsal sepal; d, lateral sepal; e, petal; f, lip; g, column; h, column apex (back view); i, column apex (front view); j, column apex (side view); **Aphyllorchis montana**: k, dorsal sepal; l, lateral sepal; m, petal; n, lip; o, column (side view); p, column apex (side view, anther removed); q, column apex (back view); r, column apex (front view); s, anther with pollinia. Drawn by Susanna Stuart-Smith, a–j from *Wood* 6403 (E); k–s from *Thwaites* 3189 (K).

Sweden, solitary male leaf-cutter bees of the genus *Chelostoma*, visited the flowers of *C. rubra* (L.) L.C. Richard. He was able to demonstrate that in the bees' visual system *C. rubra* mimics the floral coloration of *Campanula persicifolia*. *C. rubra* flowers before the *Campanula* and is pollinated by early-emerging male bees. The female bees, however, gather pollen almost exclusively from the *Campanula*. Some species of *Cephalanthera* may lack a rostellum so that self-fertilisation can occur in the bud, accounting for a very high seed-set in those species.

LECTOTYPE. *Cephalanthera damasonium* (Miller) Druce.
ETYMOLOGY. From the Greek *cephalon* (head) and *anthera* (anther, stamen) referring to the single stamen found in this genus.

Key to species

1. Lip simple, unadorned .... 2. *C. erecta* var. **oblanceolata**
+ Lip complex, adorned 2

2. Leaves ovate, less than 10cm long .... 1. C. **damasonium**
+ Leaves linear-lanceolate to lanceolate, more than 10cm long .... 3. C. **longifolia**

1. C. **damasonium** (Miller) Druce in Ann. Scott. Nat. Hist. 1906: 225 (1906). Lectotype: [icon.] '*Damasonium alpinum, sive Elleborine, floribus albus*' in J. Bauhin, Hist. Pl. 3(2): 516 (1651)! designated by Renz & Taubenheim, Fl. Turkey 8: 461 (1984).
Serapias damasonium Miller, Gard. Dict. ed.8: (1768).
Cephalanthera pallens (Willdenow) L.C. Richard in Mém. Mus. Hist. Nat. 4: 60 (1818).
C. grandiflora (L.) S.F. Gray, Nat. Arr. Brit. Pl. 2: 210 (1821).
C. lancifolia (L.) Dumortier, Fl. Belg.: 134 (1827).
C. alba (Crantz) Simonkai, Enum. Fl. Transsilv.: 504 (1886).
C. latifolia (Miller) Druce in J. Bot. 45: 240 (1907).
C. yuennanensis Handel-Mazzetti, Symb. Sin. 7: 1339 (1936). Type: China, Yunnan, nr. Lijiang, *Handel-Mazzetti* 3985 (holo. WU, iso. W!).

Plant up to 60cm tall; *rhizome* short, creeping with thick roots. *Leaves* alternate up stem, oblong-ovate becoming lanceolate above, 4–8 × 2–3.5cm; basal leaves reduced to sheaths 2.5–3.5cm long. *Inflorescence* laxly spicate, up to 15-flowered; rachis 6–7cm long; floral bracts lanceolate, green, exceeding the ovary, 2.5–3.5cm long. *Flowers* seldom fully opened, 1.5–2.5cm long; white with orange-yellow markings on the lip; ovary sessile, spirally twisted, 1–1.5cm long. *Sepals* and *petals* similar, ovate-lanceolate, acute, c.2 × 0.8cm. Lip shorter than the sepals, 1.2–1.4 0.5–0.7cm; hypochile with an orange-yellow basal mark, concave; epichile cordate, with up to 5 orange ridges at base. *Column* erect, straight to weakly curved, 7–8mm long. *Fruit* cylindric-fusiform, 2–3 × 0.3–0.5cm. **Plate 2.**

Bhutan: C – Punakha (Tang Chu, Wangdi Phodrang (field record), Zamjetin) and Tashigang (4km before Tashi Yangtsi) districts. In *Quercus griffithii*, *Lyonia ovalifolia* and *Pinus roxburghii* forest; 1990–2550m. Fl. May–June.

GENERAL DISTRIBUTION. Europe, the Near East, Caucasus, E Himalaya and China.
ETYMOLOGY. The great Roman naturalist Pliny the Elder (Caius Plinius Secundus, AD 23–79), who died while observing the eruption of Vesuvius, wrote a lengthy account of botany and the medicinal properties of plants entitled *Historia Naturalis* in which many plants were described. One of these plants he called *Damasonion* and is now thought to refer to the common water-plantain, *Alisma plantago-aquatica*. However, the *Historia Naturalis* was regarded as an important scientific source book by later botanical writers who frequently used names from it when describing new plants, but often to plants different to those intended by Pliny.

NOTES. Cribb & Chen (1997) examined the Chinese species *C. yuennanensis* and considered it to be conspecific with *C. damasonium*. This is the first report of the species from Bhutan.

2. **C. erecta** (Thunberg) Bl., Coll. Orchid.: 188, t.65, f.2 (1858). Type: Japan, Kutjinawa, *Thunberg* s.n. (holo. UPS-THUNB! Herb. no. 21322).
Serapias erecta Thunberg, Fl. Jap.: 27 (1784).

var. **oblanceolata** N. Pearce & P.J. Cribb in Edinb. J. Bot. 58(1): 110 (2001). Type: Bhutan, Mishichen to Khosa, *Kanai, Murata, Ohashi, Tanaka & Yamazaki* 13575 (holo. TI!).

Plant 18–30cm tall. *Stem* 1–3mm thick, leafy, leaves sheathing basally. *Leaves* distichous up stem, ovate to ovate-lanceolate, acute to subacute, sessile, prominently 3-to 5-veined, 5–7 × 1.5–2cm. *Inflorescence* racemose, 6- to 8-flowered; rachis 4–7cm long; floral bracts lanceolate, acute, 2–3 × 0.5–1mm, lowest floral bract leaf-like, lanceolate, acute, c.2 × 0.3cm. *Flowers* 0.7–0.9cm long, white; pedicel and ovary 5–8mm long. *Dorsal sepal* oblanceolate, subacute, 3-veined, 1 × 0.2cm; *lateral sepals* lanceolate, subacute, 3-veined, 9 × 2mm. *Petals* oblanceolate, obtuse, 3-veined, 9 × 1.5mm. *Lip* simple, peloric, oblanceolate, obtuse, 3-veined, 9 × 2mm. *Column* straight, erect, narrowly winged at apex, c.3.4mm long; stigma broad, fleshy; pollinia 1.5 × 1mm.
Bhutan: C – Punakha district (between Rimchu and Khosa). 1400–1600m. Fl. May.

DISTRIBUTION. Bhutan.
ETYMOLOGY. From the Latin *oblanceolatus* (reverse-lanceolate) in reference to the lip shape.
NOTE. We believe that this specimen represents a peloric variety of *C. erecta*; the lip is simple, unadorned and spurless.

3. **C. longifolia** (L.) Fritsch, Oesterr. Bot. Z. 38: 81 (1888). Neotype: based on Oeder, Fl. Danica 3(9): t.506, f. media (1770)!, designated by Baumann *et al.* in Mitt. Bl. Arbeit. Heim. Orch. Baden-Württ. 21: 443 (1989).
Serapias helleborine var. *longifolia* L., Sp. Pl.: 950 (1753).
Cephalanthera ensifolia (L.) L.C. Richard in Mém. Mus. Hist. Nat. 4: 60 (1818).
C. acuminata Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 412 (1840). Type: Nepal, coll. *Wallich* Wall. Cat. 7405 (syn. K-LINDL! isosyn. K-W!); Nepal. *Royle* s.n. (syn. K-LINDL!).
C. thomsonii Rchb. f. in Linnaea 41: 54 (1877) Type: India, Sikkim, 1857, *Thomson* s.n. (holo. W!), **syn. nov.**
Limodorum acuminatum (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 672 (1891).

Plant up to 60cm tall; *rhizomes* short, c.2cm long; *roots* clustered. *Leaves* 4–12, lanceolate to linear-lanceolate, sheathing, fresh green, alternate up stem, 8–18 × 2–4cm. *Inflorescence* a fairly dense, secund raceme of up to 20 flowers; rachis 6–10cm long; floral bracts small, lanceolate, acute to acuminate, shorter than the ovary, 5–7mm long. *Flowers* semi-open, 1–1.5cm long; white with a small orange patch on the hypochile and orange ridges on the epichile; pedicel and ovary slender, glabrous, 0.6–1cm long. *Sepals* similar, ovate-lanceolate, acute, 5-veined, 1.2–1.8 × 0.4–0.6cm wide. *Petals* ovate, subacute, 5- to 7-veined, 8–9.3 × 3–4.2mm. *Lip* 2-lobed, 0.7- 1 × 0.8–0.9cm (across lateral lobes, when spread); hypochile lobes triangular, subacute, 3–4mm long; epichile broadly cordate, apically papillose-tuberculate, apical margin finely dentate; disc with up to 7 orange ridges, margins finely dentate. *Column* long, terete, with 2 forward-pointing wings near apex, c.6.5mm tall; stigma stalked, c.0.15mm across; anther 2.2–2.5mm long. *Fruit* ridged, 1–2 × 0.4–0.8cm. **Fig. 8; Plate 3.**
Bhutan: S – Chukka district (Sinchula); C – Ha (Damthang, Ha Chu below Ha Dzong, Ha Valley), Ha/Thimphu (Chelai La, Sage La); Thimphu (Dotena, Pangri Zampa, Paro Chu, Thimphu, Tsalimaphe), Punakha (Gangtey Gompa to Phobsikha, Rimchu to Khosa (F.E.H.2)), Tongsa (Longte Chu), Bumthang (Bumthang Valley, Lami Gompa to Byakar) and Mongar (Khoma Chu, Pangkar, Reb La) districts;

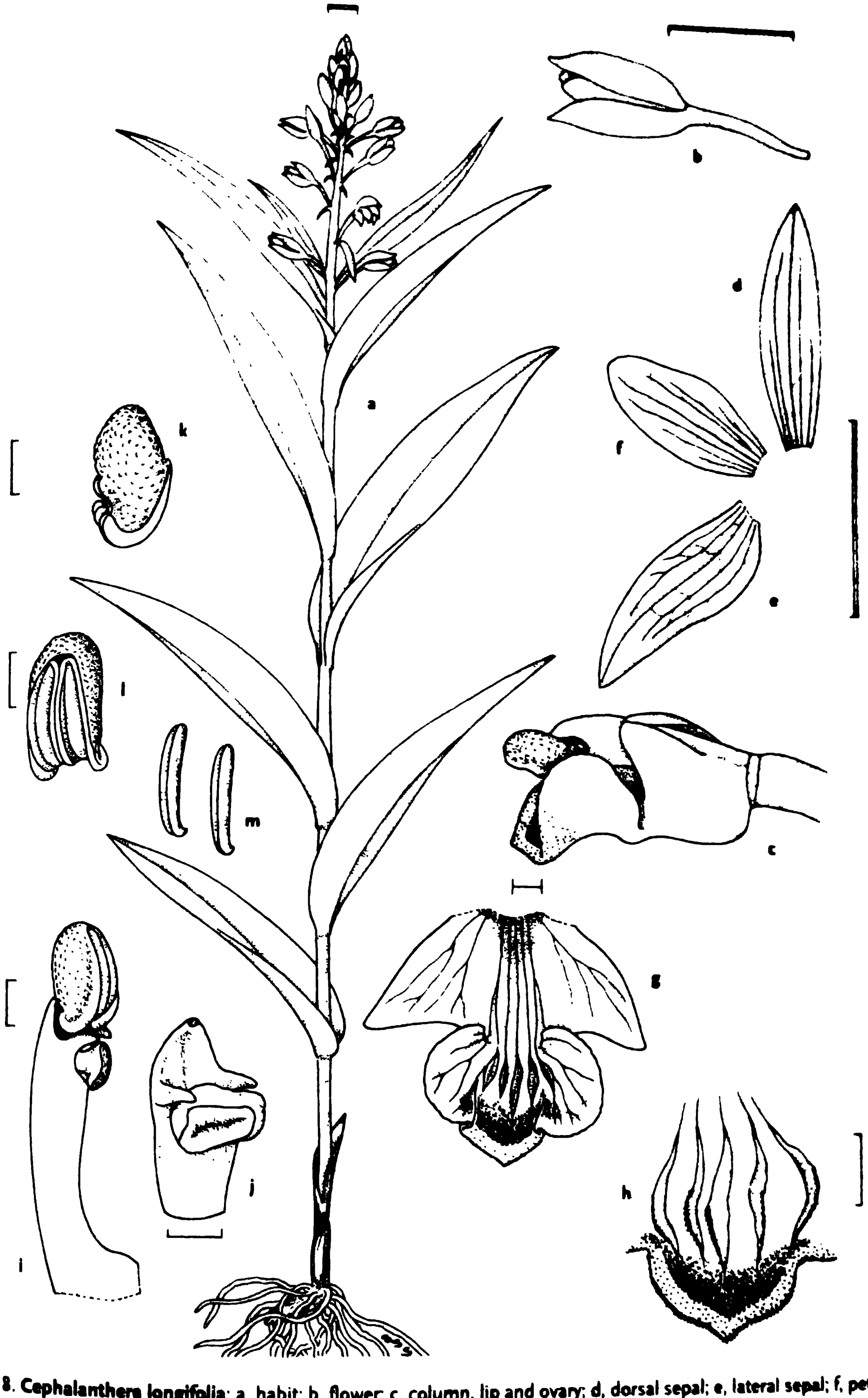


Fig. 8. **Cephalanthera longifolia**: a, habit; b, flower; c, column, lip and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip (detail); i, column; j, column apex; k, anther cap (side view); l, anther cap (front view); m, pollinia. Drawn by Susanna Stuart-Smith from *Schickhoff* 194 (K), roots from *Bedi* 59 (K).

N – Upper Kulong Chu district (near Tobrang (M.F.B.)); **Sikkim** (Pat Zee-La); **Chumbi** (Yatung and Pipitang). In open woodland, on steep grassy slopes, in *Pinus wallichiana* and *P. roxburghii* forest, in semi-shade on moist base-rich soils or dry rocky ground; 2250–3100m. Fl. April–June.

GENERAL DISTRIBUTION. Through Europe, N Africa to the E Himalaya.
ETYMOLOGY. From the Latin *longus* (long) and *folius* (leaf) in reference to the sword-like leaves.
NOTES. *C. thomsonii* was described in 1877 by Reichenbach, who based the description upon a specimen from Sikkim. The specimen, which is in the Reichenbach herbarium, comprises two plants and an associated drawing. It was overlooked by Hooker (1890) and has not, to our knowledge, been collected since. Jain & Mehrotra (1984) considered it to be a distinct, endemic species and possibly now extinct. Having examined the type material we believe that it is indistinguishable from *C. longifolia*.

9. Epipactis Zinn

Plants terrestrial, usually autotrophic, rarely mycotrophic; *rhizome* horizontal, with fleshy roots. *Leaves* spirally arranged, plicate. *Inflorescence* terminal, racemose, more or less secund, laxly to densely few- to many-flowered; peduncle erect, leafy. *Flowers* pedicellate, spreading or pendent; ovary pedicellate. *Sepals* and *petals* free, subsimilar, spreading or connivent. Lip 2-lobed, fleshy; hypochile concave; epichile flat to slightly convex, porrect, with raised swellings at the base. Column short; rostellum large and globose; pollinia 2, mealy.

The genus *Epipactis* was established in 1757 by the German physician and botanist, Johann Gottfried Zinn in the *Catalogus Plantarum Horti Academici et Agri Gottingensis* and the name has been conserved over earlier usage. The genus comprises about 15 species distributed in Europe, the Middle East, Africa, temperate Asia and N America.

Epipactis has relatively open nectaries near the base of the lip and attracts a variety of insect pollinators. Ivri & Dafni (1977) report that in Israel *E. consimilis* D. Don is pollinated by eight species belonging to five genera of hover flies (Syrphidae). They suggested that warts on the lip of this species mimic aphids and thus help to attract flies that normally lay eggs among aphids. Nilsson (1978) reported that in Sweden *E. palustris* (L.) Crantz is pollinated by bees. Van de Cingel (1995) reported pollination by long-headed wasps (*Dolichovespa* sp.) and described the mechanism. Self-pollination is also frequent in the genus.

Epipactis has a rostellum that is furnished with a distinct, but probably not detachable, viscidium which disintegrates into viscid matter known as a 'diffuse viscidium' by Rasmussen (1982a).

TYPE. *Epipactis helleborine* (L.) Crantz, *typ. cons.*
ETYMOLOGY. From the Greek *epipaktis*, a word used by the ancient Greeks for a plant that curdled milk, possibly *E. helleborine*.

Key to species

1. Epichile white, with projecting tooth-like lateral lobes at base .... **4. E. veratrifolia**
+ Epichile plum-red or purple, lacking lateral lobes 2

2. Inflorescence densely many-flowered; sepals and petals green tinged with mauve or purple; flowers usually less than 1.5cm across .... **1. E. helleborine**
+ Inflorescence laxly many-flowered; sepals and petals red to plum-purple; flowers usually more than 1.5cm across 3

3. Epichile with two small hump-like ridges; apex of epichile orange .... **2. E. mairei**
+ Epichile with two large, raised, wing-like ridges; apex of epichile plum-purple .. **3. E. royleana**

Section Epipactis

1. **E. helleborine** (L.) Crantz, Stirp. Austr. Fasc. ed.2: 467 (1769). Lectotype: Herb. Burser X: 40 (UPS), designated by Cribb & Wood in Cafferty & Jarvis in Taxon 48(1): 49 (1999).

Serapias helleborine L., Sp. Pl.: 949 (1753).

S. helleborine var. *latifolia* L., Sp. Pl.: 949 (1753). Lectotype: Herb. Burser X: 39 (UPS) designated by Cribb & Wood in Cafferty & Jarvis in Taxon 48(1): 49 (1999).

Epipactis consimilis D. Don, Prodr. Fl. Nepal: 28 (1825). Type: Nepal, Gossainthan, *Wallich* s.n. (holo. BM!)

E. macrostachya Lindl., Gen. Sp. Orchid. Pl.: 461 (1840). Type: Nepal, Gossain Than, *Wallich's collectors* Wall. Cat. 7404 (holo. K-LINDL!, iso. K-W!).

E. herbacea Royle ex Lindl., op. cit. 462 (1840). India, Mussooree, icon. Royle (holo. K!).

E. intrusa Lindl. in J. Proc. Linn. Soc., Bot. 1: 175 (1857), **syn. nov.** Type: India, Sikkim, *Hooker* 323B (holo. K-LINDL!).

E. latifolia var. *intrusa* (Lindl.) Hook. f., op. cit. 126 (1890), **syn. nov.**

E. latifolia var. *thomsonii* Hook. f., loc. cit. 126 (1890). Type: China, W Xizang (Tibet), *Thomson* s.n. (holo. K-LINDL!).

E. squamellosa Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 56 (1919). Type: China, Lofou, *J. Esquirol* 1909 (holo. B).

E. yunnanensis Schltr. op. cit. 57 (1919). Type: China, Yunnan, *E. Maire* 2907 (holo. P).

E. tangutica Schltr. loc. cit. (1919). Type: China, Tangut, *Przewalski* s.n. (holo. B).

E. discolor Kränzlin in Feddes Repert. Spec. Nov. Regni Veg. 17: 100 (1921). Type: China, Yunnan, *S. Ten* s.n. (holo. C!).

E. monticola Schltr. in Acta Horti Gothob. 1: 144 (1924). Type: China, Szechuan (Sichuan), *H. Smith* 2500/3716/3669 (syn. UPS).

E. nephrocordia Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 19: 374 (1924). Type: China, Yunnan, *S. Ten* 45 (holo. B).

Amesia longibracteata C. Schweinfurth in J. Arnold Arbor. 10: 172 (1929). Type: China, Gansu, *Rock* 13216 (holo. AMES).

Epipactis ligulata Handel-Mazzetti, Symb. Sin. 7: 1341 (1936). Type: China, Yunnan, *Handel-Mazzetti* 7023 (holo. WU).

E. micrantha E. Peter ex Handel-Mazzetti in Oesterr. Bot. Z. 86: 303 (1937). Type: China, Gansu, *Trippner* 335 (holo. WU).

E. helleborine var. *intrusa* (Lindl.) Mitra, loc. cit. (1973), **syn. nov.**

Plant large, up to 100cm tall. *Stem* with 2 to 4 leaf-like sheathing bracts, 1.5–3cm long. *Leaves* up to 10 arranged spirally up the stem, ovate-lanceolate, sometimes purple tinged, 7–14 × (1.5-) 2.5–7cm; lower leaves sheath-like. *Inflorescence* one-sided, densely many-flowered; rachis 6–30cm long; floral bracts decreasing in size upwards, lanceolate, acute 1–5 × 0.1–0.7cm. *Flowers* widely open, often pendent, 0.7–1.6cm across; greenish tinged with red or violet, lip olive to purple-brown; pedicel and ovary 2–4mm long. *Sepals* and *petals* similar, ovate, glabrous, acuminate, 0.5–1.2 × 0.4–0.8cm. *Lip* 0.8–1.1cm long, width variable; hypochile cup-shaped; epichile ovate-triangular with a recurved apex and two raised protuberances. *Column* short; rostellum globose. *Fruit* ellipsoid to ovoid, 0.6–1.4 × 0.4–1cm.

Bhutan: S – Chukka district (Sinchula); **C** – Thimphu (Shanosam, Tanga Gompa) and Bumthang (Dhur Chu, Bumthang) districts; **N** – Upper Mo Chu (Soe) and Upper Pho Chu (Lhedi, Thanza) districts; **Sikkim** (Lachen Valley); **Chumbi** (Yatung). In moist and shady woods, under *Acer*, *Picea*, *Abies* and *Tsuga*; 900–3600m. Fl. July–September.

GENERAL DISTRIBUTION. Europe, Scandinavia, Siberia, Dahuria, Caucasia, Pakistan through the Himalayas to China.

ETYMOLOGY. From the the white hellebore (*Veratrum album* L.) which has similar leaves.

NOTES. When Lindley described *E. intrusa*, he remarked that the specimen seemed to be more than an attenuated, starved state of *E. latifolia*. The differences he gave were the hypochile which was pushed upwards from below, so as to be convex on the inside, and the epichile having no calluses or venules but only 3, well-defined veins ending in a point. The plant he had examined was the smallest on a sheet at K (*Hooker* 323) bearing four plants varying in size from 14cm to 36cm. We have examined this specimen and conclude that it is merely a small form of a variable species and here treat it within the synonymy of *E. helleborine*. An extended synonymy can be found in Deva & Naithani (1986) and Lang (1999).

Section **Megapactis** Schltr. in Keller & Schltr., Monogr. Iconogr. Orchid. Eur. 1: 275 (1928).

2. **E. mairei** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 55 (1919). Type: China, Yunnan, Pe-long-tsin, E. *Maire* s.n. (holo. P!).

Epipactis setschuanica Ames & Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 56 (1919).
  Type: China, Szechuan (Sichuan), Wilson s.n. (holo. A?).

E. schensiana Schltr. ex Limpricht in Feddes Repert. Spec. Nov. Regni Veg. Beih. 12: 341(1922).
  Type: China, Schenhsi, *Limpricht* 2811 (holo. B).

E. wilsonii Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 382 (1924). Type: China, Hupeh, Wilson 1159 (holo. B).

Amesia mairei (Schltr.) Hu in Rhodora 27: 105 (1925).

A. schensiana (Schltr. ex Limpricht) Hu, op. cit. 106 (1925).

A. setschuanica (Ames & Schltr.) Hu, loc. cit. (1925).

A. wilsonii (Schltr.) Hu, loc. cit. (1925).

Plant erect, 40–50cm tall. *Stem* straight to flexuous, terete, base glabrous, apex papillose-pubescent. *Leaves* 7 or 8, erect to spreading, broadly ovate to suborbicular, acuminate, glabrous, 5–8 × 4.5–5.5cm. *Inflorescence* laxly many-flowered; rachis up to 15cm long; floral bracts somewhat reflexed, elliptic to elliptic-lanceolate, acuminate, 1.5–3.5 × 0.8–1.4cm. *Flowers* medium-sized, 1.6–2.6cm across; violet, with the epichile apex orange; pedicel and ovary clavate, papillose, c.1.3cm long. *Sepals* ovate-elliptic, acute, papillose on the outside, 1–1.5 × 0.5–0.7cm. *Petals* obliquely ovate, subacute, 1–1.4 × 0.5–0.7cm. *Lip* c.1.5cm long; hypochile deeply 2-lobed, with 3 warty lines from the base to the apex, c.1.4cm wide when spread; lateral lobes falcate-triangular, obtuse; epichile oblong, fleshy, rugose, apiculate, with a pair of small, low, hump-like calluses on the lateral veins, sometimes unadorned, 5.5–1 × 0.6–0.7cm. *Column* erect, 4–7mm long. *Fruit* ovoid, long stalked, 1.4–1.6 × 0.5–0.9cm; stalk slender, 0.8–1cm long. **Plate 3.**

Bhutan: C – Tongsa district (Changkha to Chendebi); N – Upper Mo Chu district (near Tatsi Markha); **Sikkim** (Lingmo). In swamps and marshy places, on grassy shady banks; 900–4000m. Fl. June–August.

GENERAL DISTRIBUTION. Nepal, NE India to China.

ETYMOLOGY. Named after Edouard Ernest Maire, a French missionary, who collected the type specimen in Sichuan.

3. **E. royleana** Lindl., Gen. Sp. Orchid. Pl.: 461 (1840). Type: India, Kunawur (Kinnaur), Lippa, *Royle* s.n. (holo. LIV!).

Cephalanthera royleana (Lindl.) Regel in Trudy Imp. S.-Peterburgsk. Bot. Sada 6: 490 (1876).

Limodorum royleanum (Lindl.) Kuntze, Revis. Gen. Pl. 2: 672 (1891).

Amesia royleana (Lindl.) Hu in Rhodora 27: 106 (1925).

Helleborine royleana (Lindl.) Soó in Feddes Repert. Spec. Nov. Regni Veg. 24: 35 (1927).

Plant glabrous, up to 1m tall; *rhizome* elongate, with fibrous roots. *Leaves* 4–12, plicate, alternately clasping the stem, bract-like above, ovate-elliptic to broadly lanceolate, acute, 5–20 × 2–7cm. *Inflorescence* laxly up to 20-flowered; peduncle glabrous to minutely pubescent, 10–30cm long; floral bracts pale green, leafy, lanceolate, acuminate, exceeding the flowers, 1–4 × 0.3–0.7cm. *Flowers* distant, spreading, c.1.2cm across; sepals greenish-pink to plum-purple with dark red veins on outside, lip yellowish to plum with purple veins, calluses orange-red, column white; pedicel with ovary narrowly fusiform, pubescent, 1.5–1.7 × 0.2–0.25cm. *Sepals* spreading, ovate-lanceolate; dorsal sepal tapering, acuminate, concave, keeled, 1.5–2 × 0.6–0.8cm; lateral sepals falcate, oblique, acuminate, 1.5–2.4 × 0.8–0.9cm. *Petals* erect, ovate, oblique, acute, 1.3–1.7 × 0.6–0.8cm. *Lip* in two parts; hypochile concave, veins keeled on outer surface, lateral lobes bluntly triangular, 1.4–2cm wide when spread; epichile oblanceolate with a pair of wing-like corrugated calluses on lateral veins, 0.8–1.1 × 0.4–0.5cm. *Column* short, 2-horned below the anther, 5–8 × 3mm; anther cap terminal. *Fruit* ellipsoid, pendent, 2–2.5cm long. **Plate 3.**

Bhutan: C – Thimphu (Paro, Thimphu Dzong) and Tongsa (Chendebi) districts; **Sikkim** (Thalet); **Chumbi** (Lingmatang). In swamps and marshy places, on grassy banks, in *Quercus semecarpifolia* forest; 900–4000m. Fl. June–August.

GENERAL DISTRIBUTION. E Afghanistan, Pakistan, N India, Nepal and China (Xizang).
ETYMOLOGY. Named after John Forbes Royle (1798–1858) who collected the type material at Lippa in Kinnaur Province, N India. Royle was a surgeon in the East India Company and was Curator of their Saharanpur Botanic Garden in the Himalayan foothills.
NOTES. Robbins & Wood (1993) reviewed the current status of E. *royleana*. It can be distinguished from the closely related E. *mairei* by the wing-like calluses on the epichile of the lip (E. *mairei* has two hump-like calluses on the epichile). They also considered it to be distinct from E. *gigantea* Douglas ex Hook., a N American species, which has been treated as conspecific by Renz (1978) and by many other recent authors.

Section **Cymbochilium** Schltr. in Keller & Schltr., Monogr. Iconogr. Orchid. Eur. 1: 268 (1928).

4. **E. veratrifolia** Boissier & Hohenacker in Boissier, Diagn. Pl. Orient. ser.1(13): 11 (1842). Type: Iran, Mount Elbrus, near Derbend, March Mahal gorge, *Kotschy* 401.632 (holo. G!, iso. E! K-LINDL! LE W!).
Epipactis amoena Buchanan-Hamilton, Wall. Cat.: 7403A (1832), nom. nud.
E. *consimilis sensu* Wall. ex Hook. f., Fl. Brit. India 6(1): 126 (1890), non D. Don.
Limodorum veratrifolium sensu (Boissier & Hohenacker) Kuntze, Revis. Gen. Pl. 2: 672 (1891), non Willdenow.
Helleborine consimilis (Wall. ex Hook. f.) Druce in Bull. Torrey Bot. Club 36: 547 (1909), nom. illegit.
H. *veratrifolia* (Boissier & Hohenacker) Bornmüller in Beih. Bot. Centralbl. 33: 205 (1915).
Epipactis wallichii Schltr. in Anz. Akad. Wiss. Wein. Math.-Naturwiss. Kl. 62: 275 (1920). Type not located.

Plant erect, up to 150cm tall; *rhizome* short, woody, 3–4mm diameter. *Stem* straight or flexuous, densely leafy. *Leaves* alternate, ovate-lanceolate to lanceolate, acute, papery, sessile, sheathing at base, 7–25 × 2–2.5cm. *Inflorescence* laxly many-flowered, 10–15cm long; peduncle straight, glabrous below, minutely pubescent above; rachis 10–20cm long; floral bracts ovate-lanceolate, leafy, the lower exceeding the flowers, minutely pubescent, 2–4 × 0.4–0.6cm. *Flowers* spreading, 2–3cm across; sepals and petals greenish-purple with a central line of yellowish-green, lip reddish-brown with a white tip; pedicel and ovary minutely papillose, 1.5–2cm long. *Sepals* and *petals* subsimilar, ovate-lanceolate, acute, tomentose on midrib, 1–1.5 × 0.5–0.8cm; *lateral sepals* weakly falcate. *Lip* 2-lobed, 0.9–2.1 × 0.7–1.2cm; hypochile narrowly boat-shaped, oblong, adnate to column base, 1–1.2 × 1.5–1.65cm

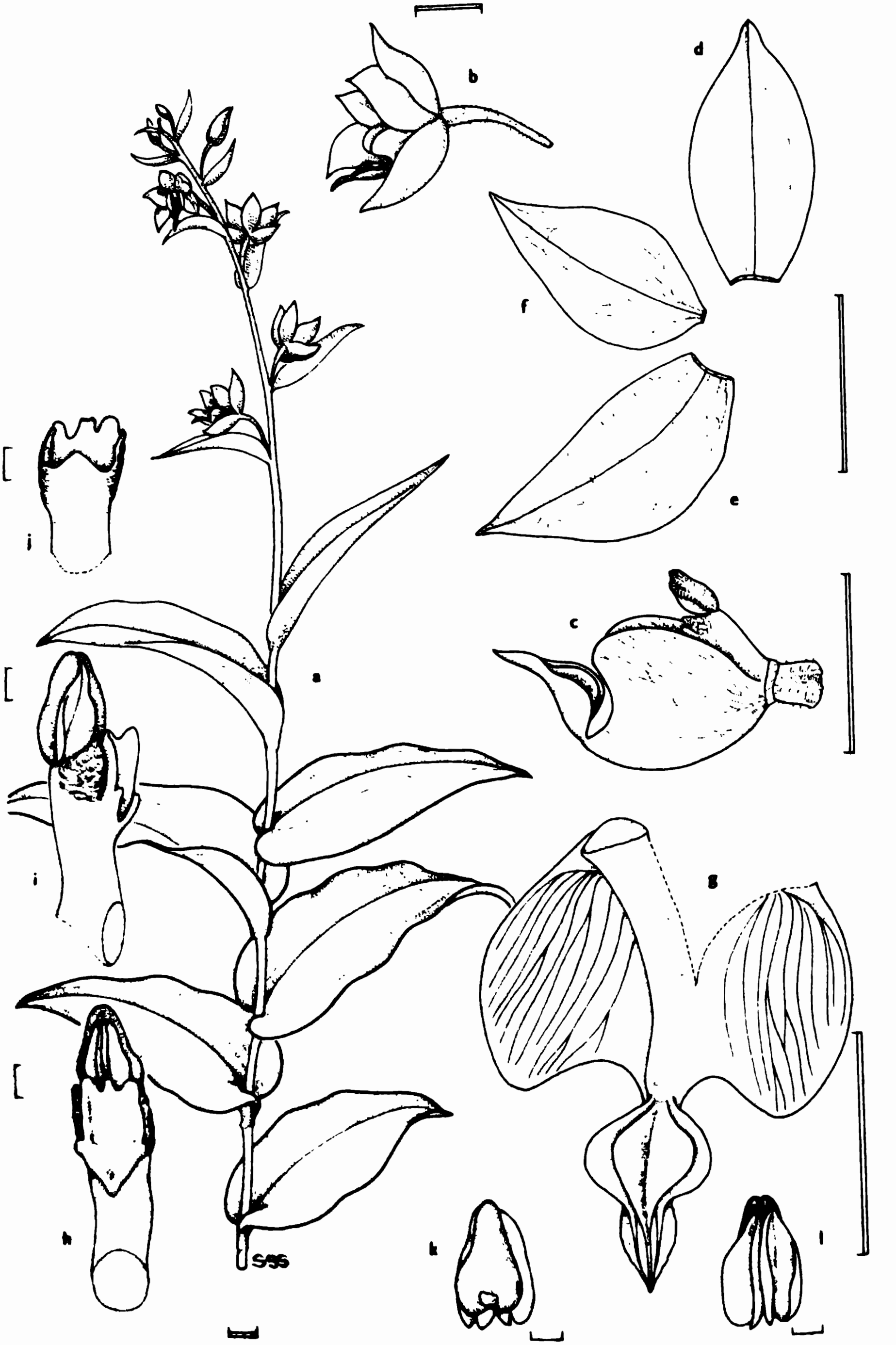


Fig. 9 **Epipactis veratrifolia**: a, habit; b, flower; c, lip and column (side view); d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (front view); i, column (side view); j, column apex (anther removed); k, anther cap (from above); l, anther cap (from below). Drawn by Susanna Stuart-Smith from *Schickhoff* 505 (K).

(when spread); epichile hastate with 2 small, erect, triangular to rounded lateral lobes, central area tuberculate-warty, 5–6mm wide (across upper half), lower half ovate-lanceolate, with 2 semi-ovate to subtriangular lateral lobes, 0.9–1.1 × 0.15–0.2cm (across lower half). Column short, curved, 4–7.5mm long; anther 3–4mm long. Fruit ellipsoid, 1.2–1.5 × 0.4–0.8cm. **Fig. 9.**

Sikkim (Tista River). In forest, under *Juniperus*, on damp base-rich soils and wet meadows; 3340m. Fl. July–September.

GENERAL DISTRIBUTION. Cyprus, Turkey, east to Nepal, India (Sikkim) and south through the Arabian peninsula to Ethiopia and Somalia.
ETYMOLOGY. From the the white hellebore (*Veratrum album* L.) which has similar leaves.

Subtribe **Listerinae** Lindl.

10. **Listera** R. Br.

Plants terrestrial; roots branched, fasciculate and fibrous. *Leaves* 2, opposite. *Inflorescence* terminal, loosely or subdensely racemose; peduncle erect. *Flowers* small. *Sepals* and *petals* subsimilar, subequal, spreading or reflexed. *Lip* porrect or pendent, entire or bifid. *Column* short, erect-curved, lacking a foot; clinandrium thin-margined; anther retrorse-inclined; pollinia mealy, 2-parted; stigma terminal, transverse.

The genus *Listera* was established in 1813 by Robert Brown in the second edition of William Townsend Aiton's *Hortus Kewensis*. The genus comprises 30 species distributed in the northern temperate zone with a few species in the Asiatic tropics and adjacent islands.

Szlachetko (1995) proposed combining *Listera* with *Neottia* but, since the reasons for this were not given, we retain the two separate genera here. Their flowers have much in common, but *Neottia* is mycotrophic whereas *Listera* is autotrophic.

Listera is primarily pollinated by nectar-seeking insects attracted to the flowers by a somewhat unpleasant fragrance. Nilsson (1981) demonstrated that the European *L. ovata* (L.) R. Br. was visited by ichneumon wasps, saw-flies and, less commonly, beetles. The rostellum of *Listera* is fragile and contains a 'parcel' of glue held under pressure. When this sensitive mechanism is activated by an insect, the rostellum explodes squirting the glue onto the unsuspecting insect (Ramsey, 1950). The margins of the rostellum then reflex, releasing the pollinia, which fall onto the fresh glue (Ackerman & Mesler, 1979).

TYPE. *Listera ovata* (L.) R. Br.
ETYMOLOGY. Named in honour of Dr Martin Lister (1638–1711), an English physician and naturalist.

Key to species

1. Leaves borne well above ground on a long stem 2
+ Leaves borne on or near ground on a short stem 7

2. Margins of lip toothed .... **3. L. dentata**
+ Margins of lip not toothed 3

3. Plant large, 30–60cm tall; leaves more than 5cm long; keel of lip mucronate at the apex **6. L. mucronata**
+ Plant small, less than 30cm tall; leaves less than 3cm long; keel of lip not mucronate at the apex 4

4. Flowers uniformly green 5
+ Flowers green with a red-brown lip 6

5. Flowers 3–5mm long; leaves usually alternate .... **1. L. alternifolia**
+ Flowers 6–10mm long; leaves always opposite .... **4. L. longicaulis**

6. Column curved, more than 2.5mm long .... **8. L. pinetorum**
+ Column straight, less than 2mm long .... **9. L. tenuis**

7. Plant large, 20–70cm tall; leaves 4–13cm long .... **7. L. ovata**
+ Plant small, less than 20cm tall; leaves up to 2.5cm long 8

8. Apex of lip 2-lobed .... **2. L. brevicaulis**
+ Apex of lip 3-lobed .... **5. L. micrantha**

1. **L. alternifolia** King & Pantling in J. Asiat. Soc. Bengal 65(2): 126 (1896). Type: India, Sikkim, Lachen valley, *Pantling* 390A (holo. CAL, iso. AMES! E! K! W!).
Neottia alternifolia (King & Pantling) Szlachetko in Fragm. Flor. Geobot. Suppl. 3: 117 (1995).

Plant 10–25cm tall. *Stem* slender, glabrous, up to 15cm tall; base with a single, blunt, oblanceolate sheath, 1.5–2.5cm long. *Leaves* 2, alternate to subopposite, obovate-elliptic, at apex of stem, 1–1.5 × 0.4–0.6cm. *Inflorescence* distantly 6- to 9-flowered; rachis puberulous, 2–4cm long; floral bracts lanceolate, acute, 2–2.5mm long. *Flowers* 3–5mm across, uniformly olive-green; pedicel and ovary 3–5mm long. *Sepals* similar, lanceolate, acute, spreading, 2.5–3.5 × 0.5–1mm. *Petals* narrowly oblong, obtuse, 2.5–3 × 0.5–1mm. *Lip* oblanceolate-oblong, exceeding the sepals, with a thickened central line from base to apex; apex obtuse, shortly 2-lobed, margins ciliate, 3–4 × c.2mm; base broad with a warty callus at each side. *Column* stout, curved, c.2mm long.

Sikkim (Lachen Valley). 3000m. Fl. July.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *alternus* (alternate) and *folium* (leaf) a reference to the usually alternate leaves, whereas all others members of the genus have opposite leaves.

2. **L. brevicaulis** King & Pantling in J. Asiat. Soc. Bengal 65(2): 126 (1896). Type: India, Sikkim, Lachen valley, *Pantling* 392 (holo. CAL, iso. AMES (photo.!) BM! K! L! W!).
Neottia brevicaulis (King & Pantling) Szlachetko in Fragm. Flor. Geobot. Suppl. 3: 117 (1995).

Plant 10–23cm tall. *Stem* very stout; glabrous, base with 2 clasping, distant, linear-lanceolate sheaths, 1–1.5cm long. *Leaves* 2, basal on stem, opposite, unequally ovate-orbicular, 0.6–2 × 0.4–1.6cm. *Inflorescence* distantly 12- to 16-flowered; rachis glabrous, 4–6cm long; floral bracts ovate-lanceolate, acute, exceeding the pedicel and ovary, 5–6 × 1–1.2mm. *Flowers* up to 6mm long, uniformly dull olive-green, central ridge of the lip brown; pedicel and ovary clavate, 3–5mm long. *Sepals and petals* subequal, shorter than the lip, lanceolate, acute, sub-connivent, 2.5–3.5 × 1–1.5mm. *Lip* obcordate, with a thickened mid-line through its entire length, 2.5–3mm long; apical lobes broad and obtuse, edges recurved and meeting underneath; base narrowed with 2 conical, porrect teeth at the junction with the column. *Column* c.1.5mm long.

Bhutan: C – Bumthang district (Bumthang); **Sikkim** (Lachen Valley). Growing with mosses in hemlock forest; 3000m. Fl. July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *brevis* (short) and *caulis* (stem).

3. **L. dentata** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 257, t.342 (1898). Type: India, Sikkim, Dzongri, Singalila, *Pantling* 452 (holo. CAL, iso. BM! K! W!).
Neottia dentata (King & Pantling) Szlachetko in Fragm. Flor. Geobot. Suppl. 3: 117 (1995).

Plant 20–30cm tall. *Stem* glabrous; base covered by 2 unequal sheaths, 1–3.5cm long. *Leaves* 2, opposite at apex of the stem, orbicular-cordate, acute, 2–3.5 × 2–3.5cm. *Inflorescence* laxly many-flowered; peduncle glandular-pubescent, c.1.2cm long; rachis glandular-pubescent, 7.5–10cm long; floral bracts ovate-lanceolate, acute, concave, equalling the pedicel and ovary, 1.5–3 × 1.5–2mm. *Flowers* up to 0.5cm across, uniformly green; pedicel and ovary fusiform to clavate, 1.5–3mm long. *Sepals* subequal, ovate, acute, 2–2.5mm long; *dorsal sepal* recurved; *lateral sepals* spreading. *Petals* elliptic-oblong, subacute, recurved, c.2mm long. *Lip* fleshy, reniform, clawed, margins toothed, c.2mm long; claw with 2 antrose teeth; disc with a thickened mid-line from base to apex. *Column* stout, c.1.5mm long; anther fleshy; rostellum blunt; pollinia 2, pyriform.

Sikkim (Dzongri, Singalila Range). 3000m. Fl. July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *dentatus* (toothed), a reference to the characteristic toothed margin of the lip.

4. **L. longicaulis** King & Pantling in J. Asiat. Soc. Bengal 65(2): 126 (1896). Types: India, Sikkim, Lachen valley, *Pantling* 391A (syn. CAL, isosyn. BM! L! W!); Lachen Valley, *Pantling* 391B (syn. CAL, isosyn. AMES!).
Neottia longicaulis (King & Pantling) Szlachetko in Fragm. Flor. Geobot. Suppl. 3: 117 (1995).

Plant 12–40cm tall. *Stem* stout, glabrous with 1 or 2 basal sheaths. *Leaves* 2, opposite, orbicular-ovate to reniform, subacute, at apex of stem, 1.5–3.7 × 1.2–2cm. *Inflorescence* puberulous, with 8–15 distant flowers; peduncle puberulous, 2–3cm long; rachis glandular-pubescent, 2–7cm long; floral bracts lanceolate, acute, 3–4 × 1mm. *Flowers* 0.5–1cm across, uniformly olive-green veined with darker green; pedicel and ovary 4–6mm long. *Dorsal sepal* ovate-lanceolate, erect, 7–8 × 2mm; *lateral sepals* linear-lanceolate, weakly falcate, reflexed. *Petals* ovate-lanceolate, erect, c.7mm long. *Lip* elliptic-ovate; apex deeply bifid, margins minutely ciliate, upper surface with a thickened mid-line from base to apex with glandular-pubescent, branching veins, 0.6–1.4 × 0.4–1cm. *Column* curved, 2–3mm long. *Fruit* ovoid, c.9 × 4.5mm.

Bhutan: C – Thimphu district (unlocalised *Wood* specimen); **Sikkim** (Lachen Valley). 2100–2900m. Fl. July; Fr. October.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *longus* (long) and *caulis* (stem).

5. **L. micrantha** Lindl. in J. Proc. Linn. Soc., Bot. 1: 176 (1857). Type: India, Sikkim, *Hooker* 353 (holo. K!).
Diphryllum micrantha (Lindl.) Kuntze, Revis. Gen. Pl. 2: 659 (1891).

Plant 7.5–13cm tall. *Stem* glabrous, bearing a single, oblong, obtuse sheath. *Leaves* 2, opposite at base of plant, orbicular-ovate to wedge-shaped or ovate, obtuse to subacute, sessile, 0.5–1.1 × 0.4–0.9cm. *Inflorescence* sparsely 4- to 6-flowered; peduncle minutely puberulous, 9–10cm long; rachis 3–5.5cm long; floral bracts ovate, acute, concave, half as long as pedicel and ovary, 1.5–2mm long. *Flowers* up to 3mm across, uniformly pale green, column whitish; pedicel and ovary 2–5mm long. *Sepals* and *petals* subequal, elliptic, subacute, spreading, 1-veined, 2–3.3 × 1–1.5mm. *Lip* quadrate, decurved, equalling the sepals, 3-veined, 2–2.5 × 0.5–1.7mm (when spread); base auriculate, broadly 2-lobed; apex 3-lobed, central lobe exceeding the lateral lobes, surface smooth. *Column* straight, 0.8–1mm long;

anther depressed, anterior edge truncate; rostellum short. Fruit ovoid-globose, c.4 × 2.5mm. Fig. 10k–t.

Bhutan: N – Upper Kulong Chu district (Lao); **Sikkim** (Phontong, Lachen Valley, Singalila Range). On moss-covered boulders; 3000m. Fl. July–August; Fr. October.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Greek *micros* (small) and *anthos* (flower).

6. **L. mucronata** Panigrahi & J.J. Wood in Kew Bull. 29(4): 731, t.1 (1974). Type: Nepal, without precise locality, *Barclay & Synge* 2410 (holo. K!).
Neottia mucronata (Panigrahi & J.J. Wood) Szlachetko in Fragm. Flor. Geobot. Suppl. 3: 118 (1995).

Plant creeping, with fleshy roots, 30–60cm tall. *Stem* smooth, glabrous, longitudinally ribbed, with 2 basal sheaths, 13–27 × 0.2–0.4cm. *Leaves* sessile, orbicular-ovate to cordate, membranous, upper surface pale green to grey-green, margins entire to undulate, 7- to 8-veined, 5–7.5 × 4–5.5cm. *Inflorescence* 12- to 14-flowered; peduncle glandular-pubescent, 13–21cm long; floral bracts ovate-orbicular, acute, 1-veined, 3–7 × 0.5–3mm. *Flowers* 0.9–1.2cm long, uniformly green; pedicel and ovary glandular-pubescent, 4–6mm long. *Sepals* subequal, membranous; *dorsal sepal* c.5 × 1–2mm. *Petals* linear-oblanceolate, c.4mm long. *Lip* adnate to base of the column, obovate-spathulate, flat; apex deeply 2-lobed; upper surface with a broad, indistinct keel from the base, shortly mucronate; 0.9–1.2 × 0.7–1.1cm wide. *Column* stout, broad, 1.5–2mm long; rostellum short, obtuse.

Bhutan: C – Punakha district (Mara Chu). On open, very wet, stream beds; 2250–2500m. Fl. May.

GENERAL DISTRIBUTION. India, Nepal, China and Japan.
ETYMOLOGY. From the Latin *mucronatus* (abruptly terminated by a hard, short point) in reference to the end of the lip keel.
NOTES. L. *mucronata* has not previously been reported from Bhutan. Deva & Naithani (1986) included L. *mucronata* under the synonymy of L. *pinetorum*. However, we have examined a large number of specimens, including the types of both species, and feel that on the basis of the plant and leaf size, and the mucronate keel their separation is justified.

7. **L. ovata** (L.) R. Br. in Aiton, Hort. Kew. ed.2(5): 201 (1813). Lectotype: Herb. LINN 1056.10 (LINN!), designated by Renz in Nasir & Ali, Flora of Pakistan 164: 10 (1984).
Ophrys ovata L., Sp. Pl.: 946 (1753).
Neottia ovata (L.) Bluff & Fingerhuth, Comp. Fl. German. ed.2(2): 435 (1825).
Diphryllum ovatum (L.) Kuntze, Revis. Gen. Pl. 2: 659 (1891).

Plant 30–70cm tall; *rhizome* short, with filiform roots. *Stem* erect, downy towards apex. *Leaves* 2, opposite at base of plant, ovate-orbicular, spreading horizontally, 4–13 × 3–8cm. *Inflorescence* terminal, loosely to densely many-flowered, up to 25cm long; rachis 6–9cm long; floral bracts minute, ovate, acuminate, c.3mm long. *Flowers* up to 1.3cm long; sepals and petals yellowish-green, lip yellowish; pedicel and ovary 6–8mm long. *Sepals* similar, campanulate, connivent, ovate, 4–5 × c.2mm. *Petals* linear, 4–5 × c.1mm. *Lip* 0.7–1.5cm long, bifid with obtuse linear lobules, linear-obovate with a deep sinus; basal nectary bounded at the sides by ridges. *Column* c.1mm long. *Fruit* ovoid, stalked, 4–7 × 3–5mm.

Sikkim (Bose & Bhattacharjee (1980)). In woodland and poor grassland, on deep base-rich soils; to 2000m. Fl. May–July.

GENERAL DISTRIBUTION. Europe, Near East, Himalayas, Asia, Caucusus and Siberia.
ETYMOLOGY. From the Latin *ovatus* (ovate) in reference to the leaf shape.

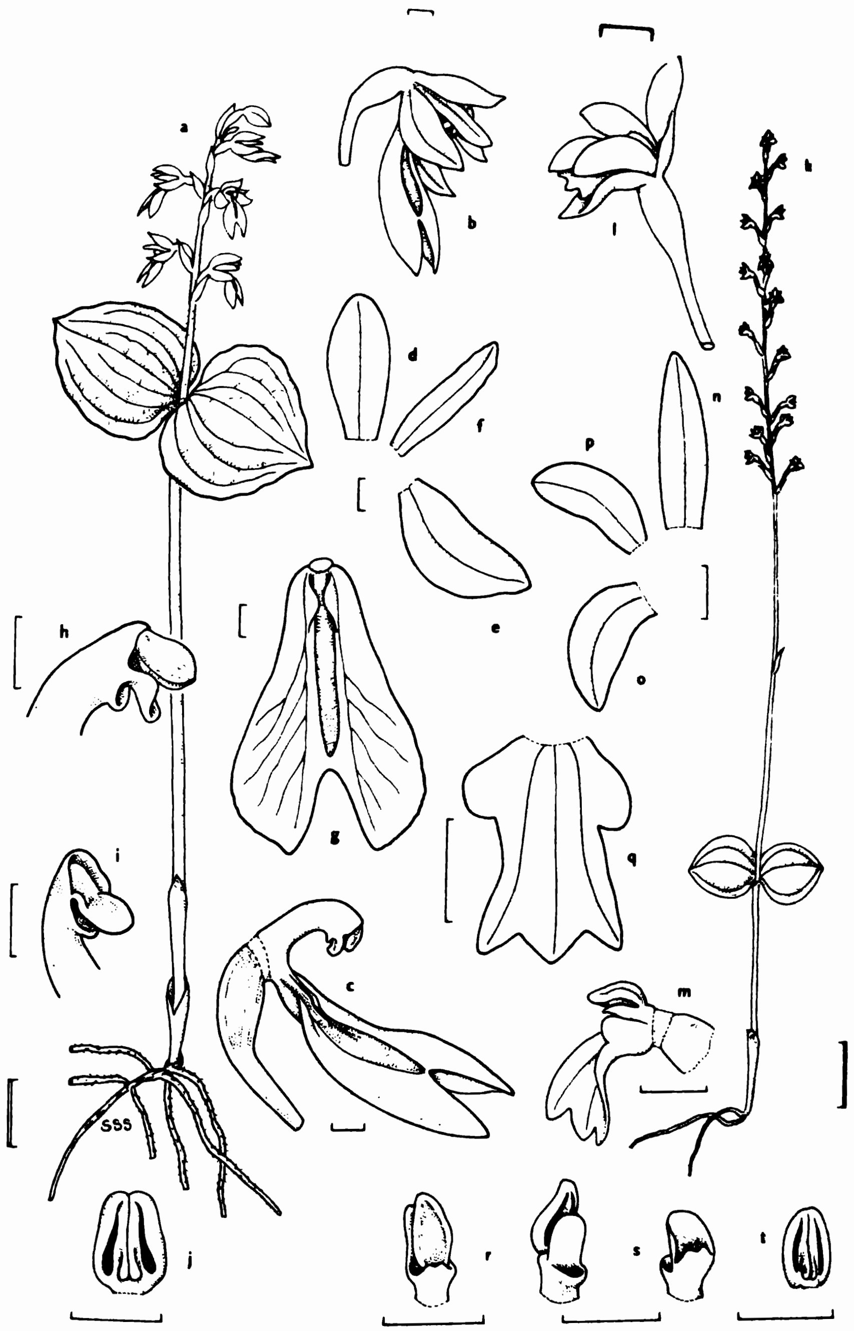


Fig. 10. **Listera pinetorum**: a, habit: b, flower; c, lip, column and ovary (side view); d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column apex (side view); i, column apex (detail); j, anther. **L. micrantha**: k, habit; l, flower; m, lip and column (side view); n, dorsal sepal; o, lateral sepal; p, petal, q, lip; r, column apex (two views); s, column apex (with anther removed); t, anther. Drawn by Susanna Stuart-Smith, a–j from *Sterling et al.* 300 (K); k from *Pantling* 377 (K); l–t from *Hooker* s.n. (K).

8. L. pinetorum Lindl. in J. Proc. Linn. Soc., Bot. 1: 175 (1857).Type: India, Sikkim, Lachen Valley, *Hooker* 355 (holo. K!).

Diphryllum pinetorum (Lindl.) Kuntze, Revis. Gen. Pl. 2: 659 (1891).

Listera brachybotryosa T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 64 (1951). Type: China, Sikang, *C.W. Wang* 65223 (holo. PE!).

L. yueana T. Tang & F.T. Wang, op. cit. 65 (1951). Type: China, NW Yunnan, *T.T. Yü* 19644 (holo. PE!).

Neottia pinetorum (Lindl.) Szlachetko in Fragm. Flor. Geobot. Suppl. 3: 118 (1995).

Plant 12–28cm tall; *roots* puberulous, clustered. *Stem* glabrous, sheathed at base, evaginate above, 4.5–14cm long. *Leaves* 2, opposite at stem apex, sessile, broadly cordate, acute, 2–3.5 × 1.5–3.5cm. *Inflorescence* laxly 2- to 10-flowered; rachis puberulous, 4–7.5cm long; floral bracts ovate-lanceolate, acuminate, convolute, shorter than the ovary, 3–4mm long. *Flowers* 0.8–1cm long; sepals and petals pale green-white with brownish-red lip, column reddish-brown with a green apex; pedicel and ovary glabrous, 4–5mm long. *Sepals* subequal, spreading, ovate-oblong, subacute, 1-veined, 3–4.7 × 2–3mm. *Petals* linear-oblong, subacute, 1-veined, 4–5 × 1–1.5mm. Lip simple, obovate-oblong, broadest at the apex, with a dark central mid-line, apex deeply bifid, 6–9 × 6–6.5mm (when spread); apex divided into 2 obtuse lobules; upper surface with 2 small, erect, triangular calluses near the base. Column cylindric, curved, 2.5–3.4mm long; rostellum obtuse; pollinia clavate. Fruit ovoid, ridged, erect, 5–6 × 2.5–3mm. **Fig. 10a–j.**

Bhutan: C – Thimphu (Barshong to Dotena, Pumo La), Bumthang (Chumey, Dhur, Nakhang) and Mongar (Lisipang (M.F.B.)) districts; **N** – Upper Mo Chu (near Laya) and Upper Bumthang Chu (Pangotang to Chamka) districts; **Darjeeling** (Phalut to Ramam); **Sikkim** (Lachen Valley, Kupup Valley, Phedang, Choka); **Chumbi** (Rinchengang, Yatung). In *Pinus*, *Abies*, *Tsuga* and *Rhododendron* woods, on moss or boulders, by streams; 3100–3700m. Fl. June–July(–August); Fr. May.

GENERAL DISTRIBUTION. NE India and China (Xizang, Yunnan).

ETYMOLOGY. From the Latin *pinetorum* (of pine woods).

9. L. tenuis Lindl. in J. Proc. Linn. Soc., Bot. 1: 176 (1857). Type: India, Sikkim, Lachen valley, *Hooker* 354 (holo. K!).

Neottia tenuis (Lindl.) Szlachetko in Fragm. Flor. Geobot. Suppl. 3: 119 (1995).

Plant 10–18cm tall; *roots* long-filiform, puberulous. *Stem* glandular-puberulous; basal sheaths 1 or 2, tubular, 1–1.5cm long. *Leaves* 2, opposite at stem apex, elliptic-ovate, acute, sessile, 1–2–1.6 × 0.4–1cm. *Inflorescence* laxly 4- to 8-flowered; rachis glandular-puberulous, 1.5–3cm long; floral bracts membranous, ovate, acute, 1-veined, 1.5–3 × 0.5–0.8mm. *Flowers* 5–6mm long; sepals and petals olive-green with pale brown lip with a dark mid-line; pedicel and ovary clavate, 3.5–5mm long. *Sepals* and *petals* similar, connivent, oblong-ovate, acute to subacute, 3–4mm long. Lip simple, wedge-shaped to obcordate, 2-lobed at apex, 4–5 × 2–3mm; apical lobules rounded, upper surface with a dark mid-line, margins entire to weakly undulate; base with a small pit. Column straight, c.2mm long; rostellum obtuse; anther papillose.

Sikkim (Di Chhu and Lachen Valley). In subalpine *Betula utilis* and *Rhododendron* forest, moist meadows; 3330–4130m. Fl. July–August.

GENERAL DISTRIBUTION. NE India and China (Xizang).

ETYMOLOGY. From the Latin *tenuis* (slender, fine) referring to the stem.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

L. divaricata Panigrahi & P.G. Taylor in Kew Bull. 30: 559 (1975). Type: India, Delei Valley, Kingdon-Ward 8572 (holo. K!).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

11. **Neottia** Guettard

Plants terrestrial, mycotrophic, lacking chlorophyll, leafless; *rhizome* robust with densely crowded, fleshy roots. *Stem* erect, covered with sheathing bracts. *Inflorescence* racemose, laxly to densely many-flowered. *Flowers* fleshy, glabrous, yellowish-brown. *Sepals* and *petals* subsimilar. *Lip* porrect, apex entire or 2-lobed. Column elongate; anther suberect; pollinia 2, mealy; stigma suborbicular to reniform.

The genus *Neottia* was established in 1754 by the French naturalist, Jean Étienne Guettard in his *Histoire de l'Académie Royale des Sciences, Paris (Huitième Mémoire sur les Glandes des Plantes)*. The genus comprises about nine species widely distributed in northern temperate zones of the Old World.

The pollination mechanism is similar to that of *Listera*. The viscidium is explosively freed by the touch of an insect visitor (van der Pijl & Dodson, 1966).

TYPE. *Neottia nidus-avis* (L.) L.C. Richard; basionym: *Ophrys nidus-avis* L.
ETYMOLOGY. From the Greek *neottion* (nest-building) in reference to the tangled mass of roots.

Key to species

1. Flowers more than 5mm across; rachis more than 10cm long .... **2. N. listeroides**
+ Flowers less than 5mm across; rachis less than 10cm long 2

2. Flowers pale brown with a white anther; lip simple, ovate .... **1. N. acuminata**
+ Flowers dull-red; lip bifid, oblong .... **3. N. pantlingii**

1. N. acuminata Schltr. in Acta Horti Gothob. 1: 141 (1924). Types: China, N Szechuan (Sichuan), Dongrergo, Huang-lung-ssü, H. Smith 3859 (syn. UPS!, isosyn. GB!); Dongrergo, Huang-lung-ssü H. Smith 3940 (syn. UPS!); Karlong, H. Smith 2997 (syn. UPS!).
Neottia micrantha sensu Lindl., Gen. Sp. Orchid. Pl.: 458 (1840), non La Llave & Lex (1825), non G. Don (1839).
Aphyllorchis parviflora King & Pantling in J. Asiat. Soc. Bengal 65(2): 128 (1896). Type: India, Lachung Valley, Pantling 383A (holo. CAL, iso. AMES! E! BM! K! W!).
Neottia parviflora sensu (King & Pantling) Schltr. in Acta Horti Gothob. 1: 142 (1924), non J.E. Smith (1813), in obs.
N. asiatica Ohwi in Bot. Mag. (Tokyo) 45: 384 (1931). Type from Japan.
N. subsessilis Ohwi op. cit. 385 (1931). Type from Japan.
N. oblonga T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 66 (1951). Type: China, Yunnan, C.W. Wang 66312 (holo. PE).

Plant up to 25cm tall; *rhizome* short, with many fibrous fasciculate, rootlets. *Stem* erect, glabrous; sheaths 4–5, 0.5–6cm long. *Inflorescence* laxly to subdensely many-flowered; rachis 3–7cm long; floral bracts lanceolate, obtuse, 2–3mm long. *Flowers* non-resupinate, up to 3mm across; pale brown, anther white, pollinia yellow; pedicel and ovary swollen, not twisted, 4–5mm long. *Sepals* subequal, linear-oblong, acuminate, spreading, apex recurved, 3–4mm long. *Petals* smaller than sepals, narrow, keeled externally, 2–2.5mm long. Lip simple, ovate, 1.5–2.5mm long; base broad, obtusely lobed, subacute, concave. Column c.0.5mm long; rostellum prominent; anther with reflexed margins; pollinia 2, clavate. **Plate 3.**

Bhutan: N – Upper Mo Chu district (Laya); **Sikkim** (Chokchurang Chhu, Lachen Valley, Yumthang). In shade, under *Rhododendron hodgsonii* and in *Abies* forest; 1000–4100m. Fl. June–July.

GENERAL DISTRIBUTION. Russia, NE India and China (Sichuan and Yunnan).
ETYMOLOGY. From the Latin *acuminatus* (tapering to a narrow point) in reference to the sepals.

2. **N. listeroides** Lindl., Gen. Sp. Orchid. Pl.: 458 (1840). Type: India, Mussooree, *Royle* s.n. (holo. K-LINDL!).
Neottia listeroides Lindl. in Royle, Ill. Bot. Himal. Mts.: 368 (1839), nom. nud.
N. lindleyana Decaisne, in Jacquemont, Voy. Inde 4: 163, t.163 (1843). Type: India, Simla, *Decaisne* s.n. (holo. BR).
Listera lindleyana (Decaisne) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 258 (1898).
Neottia dongregoensis Schltr. in Acta Horti Gothob. 1: 142 (1924). Type: China, Sichuan, Dongrergo, *H. Smith* 3712 (holo. GB).

Plant reddish-brown, 20–35cm tall; *roots* caespitose. *Stem* erect, lower half subglabrous, upper half glandular-pubescent; sheaths 3–4, loose, blunt, convolute, 3–6cm long. *Inflorescence* laxly many-flowered; rachis 7–19cm long; floral bracts oblong, acute to acuminate, pubescent, equalling the pedicel and ovary, 0.7–1.2cm long. *Flowers* 0.5–1.5cm across, uniformly reddish-brown; pedicel and ovary pubescent, 5–8mm long. *Sepals* subsimilar, elliptic-ovate, falcate, concave, subacute, 1-veined, 3–4 × 2–2.5mm; lateral sepals falcate. *Petals* linear, obtuse, smaller than the sepals, 2–5 × 0.8–1mm. *Lip* exceeding the sepals, narrowly oblong, 7–1.2 × 0.4–0.5cm; apex bifid, oblong-lanceolate, lobules acute, margins minutely pubescent; sinus broad with 2 small triangular processes at the apex; upper surface minutely puberulous, midrib thickened. *Column* curved, expanded at base and apex, 2–3mm long; anther c.0.8mm long. *Fruit* swollen, ridged, 4–6 × 3–4mm. **Fig. 11.**

Bhutan: C – Thimphu district (Thimphu); **N** – Upper Mo Chu (near Laya) and Upper Pho Chu (Lhedi) districts; **Sikkim** (Lachen Valley); **Chumbi** (Punkabeeseemoo). In deciduous woodland, under spruce; 2900–3600m. Fl. July–August.

GENERAL DISTRIBUTION. NW India, Nepal, NE India and China.
ETYMOLOGY. From the generic name *Listera*, and the Greek suffix *-oides* (indicating a resemblance).

3. **N. pantlingii** (W.W. Smith) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1–2): 66 (1951). Types: India, Sikkim, Zemu valley, *W.W. Smith & Cave* 1020 (syn. K!) Lachen valley, *W.W. Smith & Cave* 2657 (syn. CAL, drawing of syn. K!).
Aphyllorchis pantlingii W.W. Smith in Rec. Bot. Surv. India 4: 243 (1911).

Plant up to 30cm tall; *rhizomes* short, with multiple, fibrous, fasciculate roots. *Stem* 15–30 × 0.2–0.4cm; sheaths basal, subequal, scale-like, obtuse, 5–7cm long. *Inflorescence* laxly 10- to 30-flowered; peduncle glabrous, upper part red-pubescent; rachis 4–7cm long; floral bracts linear to linear-oblong, acuminate, erect, 0.5–1.6cm long. *Flowers* up to 5mm across, uniformly dull red in colour; pedicel and ovary c.1cm long. *Sepals* subequal, oblong, obtuse, 3–4mm long. *Petals* smaller than the sepals, oblong, obtuse, c.3mm long. *Lip* variable, oblong, longer and narrower than the sepals, bifid, c.4mm long. *Column* c.0.5mm long. *Fruit* ovoid, ribbed, areolate, 7–8 × c.5mm.

Bhutan: C – Ha (Sage La to Ha) and Bumthang (Pamprang) districts; **Sikkim** (Lachen Valley and Zemu Chhu). 3000–3700m. Fl. August.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named in honour of Robert Pantling, an authority on Himalayan orchids and co-author (with George King) of *Orchids of the Sikkim-Himalaya*.

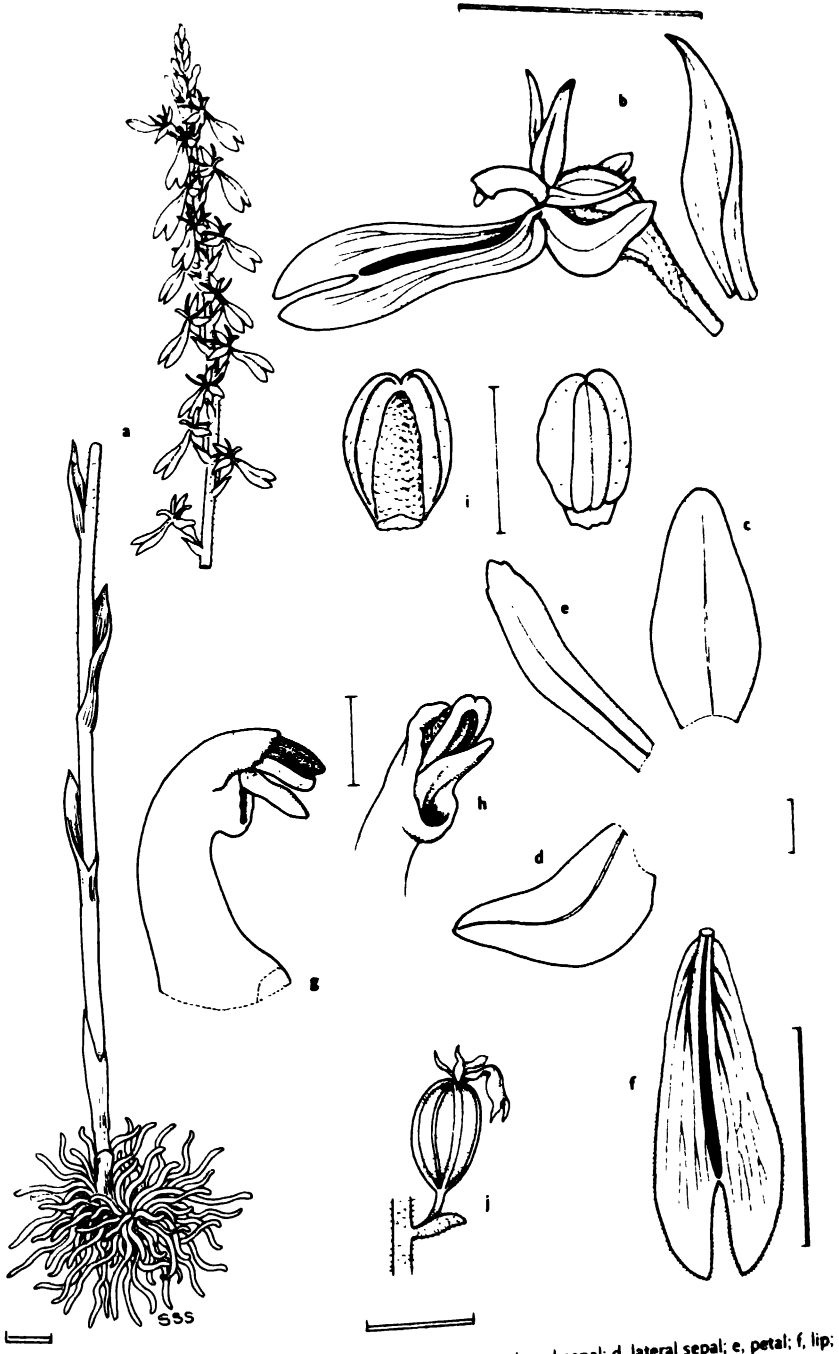


Fig. 11. **Neottia listeroides**: a, habit; b, flower (with detached bract); c, dorsal sepal; d, lateral sepal; e, petal; f, lip; g, column (from side); h, column apex; i, anther (two views); j, fruit. Drawn by Susanna Stuart-Smith, a–i from *Falconer* 1079 (K); j from *Falconer* 31015 (K).

Tribe **Nervilieae** Dressler

12. **Nervilia** Commerson ex Gaudichaud

Plants terrestrial with joined tubers. *Leaf* solitary, soft, plicate, petiolate, suborbicular with cordate base, appearing after flowering. *Inflorescence* terminal, erect, racemose, hysteranthous, 1- to several-flowered; peduncle brittle. *Flowers* not opening widely, pendent. *Sepals* and *petals* similar, free, gaping, rarely subspreading, lanceolate, acute. *Lip* erect, simple or 3-lobed, spurless. *Column* elongate, clavate, wingless; clinandrium prominent, entire or denticulate; anther incumbent; pollinia 2, granulose; stigma oblong.

The genus *Nervilia* was established in 1829 by the French naturalist Charles Gaudichaud-Beaupré and described in Freycinet's *Voyage Autour du Monde*. The genus comprises about 80 species distributed in tropical Africa, Madagascar, tropical Asia, the Malay Archipelago, the Pacific Islands and N Australia.

Taxonomically this genus has proved difficult because the inflorescence withers and disappears before the leaf develops. Since several species may grow in the same area it is not always easy to match the leaves with the flowers. Schlechter (1911, 1915) revised the sectional treatment of the genus. Seidenfaden (1978a) has reviewed the species from Thailand and adjacent areas and a fuller synonymy can be found there.

Pollination in the African species was studied by Pettersson (1989). He found that the flowers without spurs (sect. *Nervilia*) had no nectar and were pollinated by solitary wasps (Eumenidae) by deceit. Species of sect. *Linervia* have flowers with a small spur, which produce small amounts of nectar, and were pollinated by small bees (Anthophoridae and Halictidae). Species with flowers producing abundant nectar (sect. *Kyimbilaea*) were pollinated by bees (Scoliidae).

TYPE. *Nervilia aragoana* Gaudichaud, *nom. cons.*

ETYMOLOGY. From the Latin *nervus* (a vein) in reference to the prominent leaf veins.

Key to species

1. Inflorescence with 1 flower 2
+ Inflorescence with 2 or more flowers 5

2. Mid-lobe of lip pleated-crispy, fimbriately incised .... **1. N. crociformis**
+ Mid-lobe of lip with entire margins 3

3. Lip lacking hairs on the blade .... **4. N. macroglossa**
+ Lip with hairs on the blade 4

4. Lip with a single glandular-pubescent line .... **2. N. falcata**
+ Lip with 3 papillose ridges .... **3. N. infundibulifolia**

5. Inflorescence with 2 (rarely 3) flowers 6
+ Inflorescence with 3 or more flowers 7

6. Lip equalling or longer than the sepals, with distinct lateral lobes; leaves with few hairs **5. N. hookeriana**
+ Lip shorter than the sepals, lacking distinct lateral lobes; leaves with coarse hairs on both sides .... **6. N. plicata**

7. Sepals less than 2.5cm long and 0.5cm wide; hypochile lacking a sac .... **7. N. aragoana**
+ Sepals more than 2.5cm long and 0.6cm wide; hypochile forming a sac ..... **8. N. gammieana**

Section **Linervia** Schltr. in Bot. Jahrb. Syst. 45: 400 (1911).

1. **N. crociformis** (Zollinger & Moritzi) Seidenfaden in Dansk Bot. Ark. 32(2): 151, t.92 (1978). Type: Indonesia, Java, Tjikoya, *Zollinger* 762 (holo. W! Herb. no. 48199, iso. LE!).
Bolborchis crociformis Zollinger & Moritzi in Moritzi, Syst. Verz.: 89 (1846).
Pogonia crispata Bl. in Mus. Bot. 1: 32 (1849). Type from Java.
P. prainiana King & Pantling in J. Asiat. Soc. Bengal 65(2): 129 (1896). Type: India, Sikkim, Lachung Valley, *Pantling* 372 (holo. K!, iso. BM!).
Nervilia crispata (Bl.) Schltr. ex Kränzlin in Schumann & Lauterbach, Fl. Schutzgeb. Südsee: 240 (1901).
N. monantha Blatter & McCann in J. Bombay Nat. Hist. Soc. 35: 724 (1932). Type: India, N Kanara, Yellapur, *Bell* 5428 (holo. BLAT).
N. prainiana (King & Pantling) Seidenfaden in Dansk Bot. Arkiv 32(2): 149 (1978).

Plant up to 15cm tall; *tubers* globose, warty, 0.7–1.5cm across. *Scape* 3–15cm tall; basal sheaths 4–5, unequal, blunt; upper sheaths 1 or 2, acuminate, to 2cm long. *Leaf* petiolate, orbicular, reniform, plicate, 3.5–6 × 4.5–10cm; petiole 2–5cm long. *Inflorescence* 1-flowered; floral bracts minute, triangular, shorter than ovary, 1–2mm long. *Flower* up to 2cm across; sepals and petals brownish-green, lip white with a yellow centre; pedicel and ovary 0.8–1cm long. *Sepals* narrowly oblong, obtuse, 1.6–2 × 0.35–0.45cm. *Petals* linear-lanceolate, obtuse, c.1.4 × 0.3cm. *Lip* convolute over the column, exceeding the sepals, 1.5–1.8 × 0.9–1.1cm; lateral lobes short, triangular; mid-lobe shortly suborbicular, margins fimbriate; disc with c.7 densely glandular-pubescent vertical lines. *Column* clavate, 6–7mm long. *Fruit* ovoid, 1–1.7 × 0.5–0.7cm.
Sikkim (Lachung Valley). 2100m. Fl. June.

GENERAL DISTRIBUTION. Africa, India (N Kanara, Sikkim), Thailand and south to Indonesia.
ETYMOLOGY. From the genus *Crocus* (Iridaceae) in reference to the shape (and colour) of the flower.
NOTES. The Himalayan plants of this species have, until recently, been known as *N. prainiana*. Pettersson (1990) revised the African species of *Nervilia* and treated *N. prainiana* as conspecific with *N. crociformis* and concluded that 'in view of the large variation in lip morphology within the species both in Asia and Africa ... it is not possible to distinguish *N. crispata* from *N. prainiana*'. Seidenfaden (1995a) followed this treatment. The African synonyms can be found in Pettersson (1990).

2. **N. falcata** (King & Pantling) Schltr. in Bot. Jahrb. Syst. 45: 403 (1911). Type: India, Duars, east of Jaldacca river [cited as 'Bhutan'], *Pantling* 439 (holo. CAL!).
Pogonia falcata King & Pantling in J. Asiat. Soc. Bengal 65(2): 129 (1896).

Plant up to 7cm tall; *tubers* globose, warty, up to 8mm across. *Stem* arising from apex of tuber, glabrous; sheaths oblong, thinly membranous, distant along stem. *Leaf* cordate, margin undulate, apex acute, glabrous; petiole up to 4.5cm long. *Inflorescence* 1-flowered; floral bract lanceolate, exceeding the ovary. *Flower* 1–1.5cm long (including ovary). *Sepals* and *petals* subsimilar, linear, acute, 0.7–1cm long. *Lip* oblong, convolute, embracing the column, 3-lobed; lateral lobes prominent, falcate, triangular, acute; mid-lobe orbicular, upper surface with a single broad, thickened, glandular-pubescent line from base to apex; disc pubescent. *Column* clavate, puberulous; anther large, fleshy; pollinia clavate-ellipsoid.
Duars (E of Jaldacca River). Habitat unknown. Fl. April.

GENERAL DISTRIBUTION. India (Garhwal).
ETYMOLOGY. From the Latin *falcatus* (curved like a sickle) in reference to the shape of the lateral lobes of the lip.
NOTES. This species was originally described by King & Pantling in 1896 based on a collection from 'Bhutan'; no description of the leaf was given in the protologue, nor illustrated in King & Pantling (1898). The type specimen (at CAL) consists of poor material of two plants lacking leaves and was

examined by Deva & Naithani (1986), who described the leaf from other material and gave the distribution as Garhwal to Bhutan.

3. **N. infundibulifolia** Blatter & McCann in J. Bombay Nat. Hist. Soc. 35: 725, t.3 (1932). Type: India, N Kanara, Yellapur, T.R. Bell mss. icon. E. Bell (holo. BLAT).
Nervilia hallbergii Blatter & McCann in J. Bombay Nat. Hist. Soc. 35: 726 (1932). Type: India, W Ghats, Kuna, *Hallberg* s.n. (holo. BLAT).
N. calcicola Kerr in J. Siam Soc., Nat. Hist. Suppl. 9(2): 242, t.7 (1933). Type from Laos.

Plant to 11cm tall; *tuber* slightly flattened above and below, 1–1.2cm long. *Stem* tall, straight, 7–11cm tall, internodes 2; sheaths linear-oblanceolate, acute, wide-mouthed, 2.5–3cm long. *Leaf* broadly cordate, funnel shaped, margin crimped, minutely dentate-crenulate, 5- to 9-veined, petiolate, 3–4cm across; petiole sheathing at base. *Inflorescence* 1-flowered; floral bract lanceolate, acute to acuminate, concave, 3-veined, 3–7 × 2mm. *Flower* single, at right-angles to axis; sepals and petals light maroon-green, with maroon-red veins, lip apple green with lighter lateral lobes, mid-lobe white suffused with pink, column light apple-green; pedicel and ovary 6mm long. *Sepals* similar, linear-oblanceolate, acute, concave, 3-veined, 1.3–1.5 × 0.15–0.3cm. *Petals* linear-oblanceolate, acute, concave, 1-veined, 1.2–1.3 × 0.18–0.2cm. *Lip* 3-lobed, weakly saccate at base, tubular for half its length (or less), 1.5–1.7 × 0.2–0.3mm; hypochile with 2 papillose ridges; lateral lobes triangular, obtuse, folded over column; epichile broadly ovate, margins entire, rounded, central vein broadly gibbous. *Column* straight, pubescent for half its length, 5–8mm long. *Fruit* cylindric-ovoid, 0.8–1.1 × 0.4–0.55cm. **Fig. 12.**

Bhutan: C – Punakha district (Wangdi Phodrang). 1700m. Fl. June–July.

GENERAL DISTRIBUTION. India (Karnataka, Arunachal Pradesh).
ETYMOLOGY. From the Latin *infundibularis* (funnel-shaped) and *-folius* (leaved).
NOTES. This species has not previously been reported from Bhutan. Seidenfaden (1978a) and Seidenfaden & Wood (1992) discussed the relationship of this species with the closely related *N. punctata* (Bl.) Makino; it is also closely related to *N. falcata*. This relationship was also discussed by Deva & Naithani (1986), but in *N. infundibulifolia* the lower half of the column is pubescent, and not glabrous as they state. *N. calcicola* Kerr was based on a specimen from Laos (Kerr 1023, K!) which lacks pubescent lines on the lip. Further collections are required to be certain of its status, but we here include it under the synonymy of *N. infundibulifolia*.

4. **N. macroglossa** (Hook. f.) Schltr. in Bot. Jahrb. Syst. 45: 403 (1911). Types: India, Sikkim, *Hooker* s.n. (syn. K!); Sikkim, Tumlong (Tumlang), *Clarke* 27725 (syn. K!).
Pogonia macroglossa Hook. f., Fl. Brit. India 6(1): 120 (1890); Icon. Pl. 23: t.2195 (1894).

Plant small, 8–18cm tall; *tuber* globose, 1–1.5 × 1–1.5cm. *Stem* slender, glabrous, 7–15cm long, sheathed; sheaths 2, distant, clasping, 2–2.5cm long. *Leaf* petiolate, orbicular-cordate, margins entire, 3.5–4.5 × 4–5cm; petiole 5–7cm long. *Inflorescence* 1-flowered; floral bract small, linear-lanceolate, acute 3–7 × 0.6–1.1mm long. *Flower* 1–4cm long; sepals and petals white flushed with pink; pedicel and ovary short, 2–4mm long. *Sepals* and *petals* subsimilar, linear-lanceolate, acute to acuminate, 1.2–3 × 0.1–0.2cm. *Lip* obscurely 3-lobed, narrowly oblong in outline, 1.3–3.5 × 0.35–0.5cm; lateral lobes small, bifid; mid-lobe lanceolate, apex subacute, margins weakly undulate, softly pubescent, slender, veined. *Column* slender, apex clavate, 0.5–1.3cm long. *Fruit* ovoid, 1.2–4 × 0.5–0.9cm.

Bhutan: C – Punakha district (Bhotokha to Rimchu, Rimchu to Khosa); **Sikkim** (Dentam to Pemayangtse, Tumlang). In humus of *Quercus* forests in hot valleys; 600–1800m. Fl. May.

GENERAL DISTRIBUTION. Nepal, NE India and Myanmar.
ETYMOLOGY. From the Greek *macros* (large) and *glossa* (tongue) in reference to the lip.

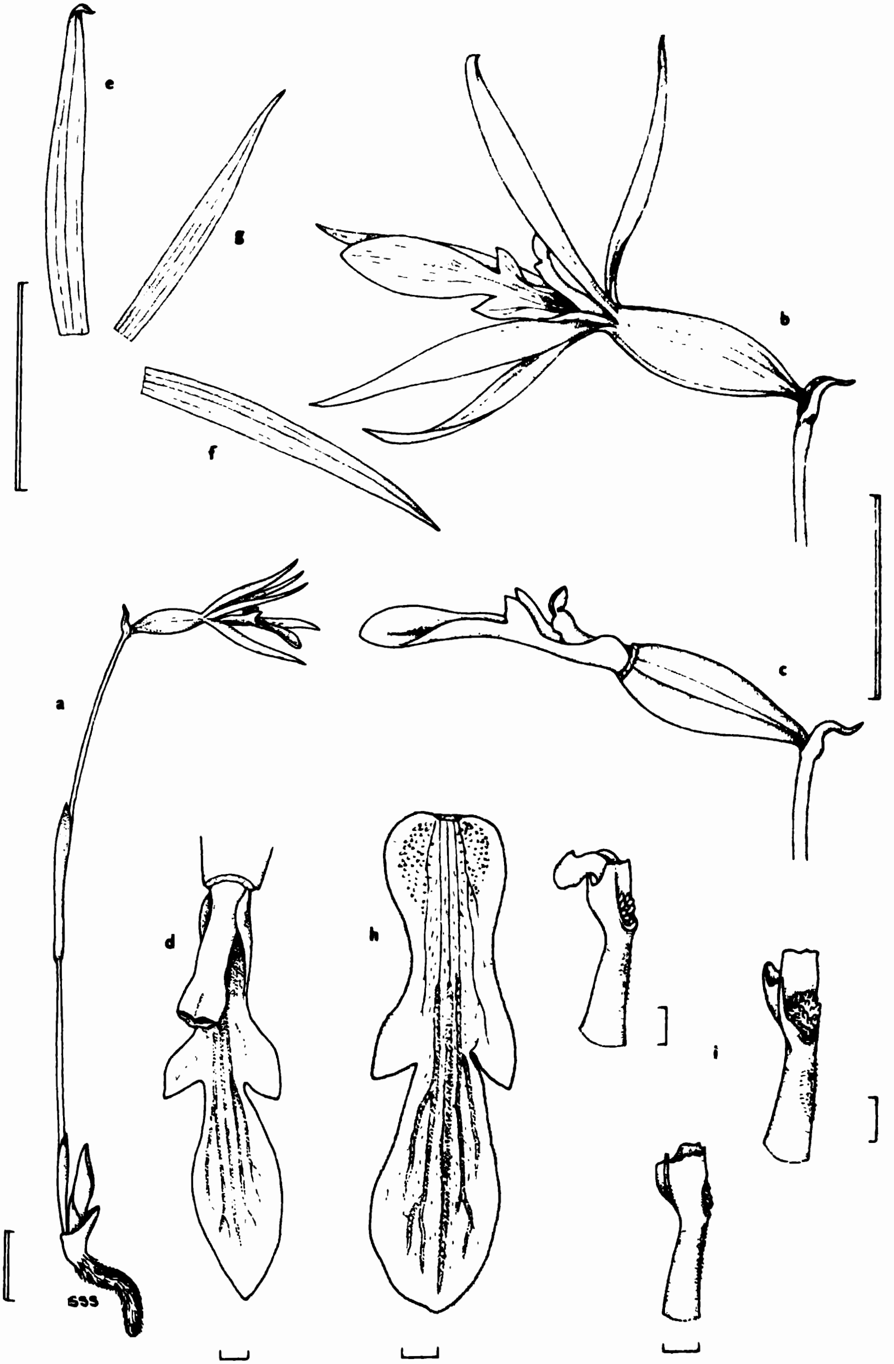


Fig. 12. **Nervilia infundibulifolia**: a, habit; b, flower; c, lip, column and ovary (side view); d, lip and column (front view); e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column (three views). Drawn by Susanna Stuart-Smith from *Gurung* 59 (E).

Section **Vinerlia** Schltr. in Bot. Jahrb. Syst. 45: 400 (1911).

5. **N. hookeriana** (King & Pantling) Schltr. in Bot. Jahrb. Syst. 45: 403 (1911). Type: India, Sikkim, King 2153 (holo. CAL!).
Pogonia hookeriana King & Pantling in J. Asiat. Soc. Bengal 65(2): 129 (1896).

Plant up to 5cm tall. *Stem* glabrous; sheaths basal, 1 or 2. *Leaf* petiolate, reniform-orbicular, margins undulate, veins minutely scabrid near the base, c.5cm wide; petiole minutely scabrid, striate, up to 5cm long. *Inflorescence* 2-flowered; floral bracts linear-lanceolate, half as long as the pedicel and ovary. *Flowers* up to 2.5cm across. *Sepals* and *petals* subequal, linear-lanceolate. *Lip* oblong; lateral lobes short, subtriangular, obtuse; mid-lobe ovate, subacute, upper surface with 3 parallel ridges extending from base to apex.

Sikkim (unlocalised King specimen). 750m. Fl. August.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after Joseph Dalton Hooker (1817–1911) who spent four years collecting plants in Sikkim, Khasia and Nepal and later became Director of the Royal Botanic Gardens, Kew.
NOTES. Pradhan (1976) listed this species as *Pogonia hookeriana* based on the information that the leaf appears with the flower, but Schlechter considered that this was a coincidence due to local climatic conditions (Seidenfaden, 1978a). King & Pantling (1898) commented that this species had only been collected once and that the exact locality was unknown. There is very little herbarium material and it is not even possible to be certain as to which genus it correctly belongs; we here follow Seidenfaden (1978a).

6. **N. plicata** (Andrews) Schltr. in Bot. Jahrb. Syst. 45: 403 (1911). Type: E Indies, cult. A.B. Lambert (holo. K!).
Arethusa plicata Andrews in Bot. Repos. 5: t.321 (1803).
Cordyla discolor Bl., Bijdr.: 417 (1825). Type from Java.
Roptrostemon discolor (Bl.) Bl., Fl. Jav. (Praef.): 6 (1828).
Epipactis plicata (Andrews) Roxb., Hort. Bengal.: 63 (1814), nom. nud.; Fl. Ind. ed.1832, 3: 454 (1832).
Pogonia plicata (Roxb.) Lindl., Gen. Sp. Orchid. Pl.: 415 (1840).
P. discolor (Bl.) Bl., Mus. Bot. 1: 32 (1849).
P. biflora Wight, Icon. Pl. Ind. Orient. 5(1): t.1758, f.2 (1851). Type: India, Wynaud, Jerdon (holo?).
P. dallachyana F. Mueller ex Bentham, Fl. Austral. 6: 310 (1873). Type from Australia.
P. velutina Parish & Rchb.f. in Trans. Linn. Soc. London 30: 142 (1874). Type: Myanmar, Moulmein, Parish 182 (holo. W! Herb. no. 48196, iso. K!).
P. pulchella Parish in Mason, Burmah: 186 (1883), nom. nud.
P. pulchella Hook. f. in Bot. Mag. 111: t.6851 (1885). Type: China, Hong Kong, Ford s.n. (holo. K!).
Nervilia dallachyana (F. Mueller ex Bentham) Schltr. in Bot. Jahrb. Syst. 39: 48 (1907).
Pogonia pudica Ames in Orchidaceae 2: 44 (1908). Type from the Philippines.
Nervilia velutina (Parish & Rchb. f.) Schltr. in Bot. Jahrb. Syst. 45: 403 (1911).
N. biflora (Wight) Schltr., loc. cit. (1911).
N. discolor (Bl.) Schltr., loc. cit.(1911).
Aplostellis velutina (Parish & Rchb. f.) Ridley, Fl. Malay. Penins. 4: 204 (1924).

Plant 12–30cm tall; tuber globose, up to 1.5cm across. *Leaf* prostrate, subsessile, cordate-orbicular, acute, margins entire to broadly denticulate, plicate, sometimes blotched with purple, with white setaceous hairs, 3–8 × 3.5–9cm; petiole 1–2cm long. *Inflorescence* erect, 2- or 3-flowered; peduncle up to 25cm long, white; floral bracts variable, ovate-lanceolate, acute to apiculate, entire or finely toothed at apex, 0.2–1.2cm long. *Flowers* subpendent; sepals and petals creamy white to greenish-brown, lip with violet streaks and a purple marginal band; pedicel and ovary 0.7–1.2cm long. *Sepals* and *petals* spreading, oblong-lanceolate, acute, sparsely dotted with tiny dark glands, 1.5–4 × 0.3–0.5cm. Lip porrect, glabrous, ovate-oblong when spread, lacking distinct lateral lobes, ecallose, 1.45–2cm long; mid-lobe ovate-oblong, with a thickened midrib, emarginate, base slightly saccate. *Column* straight, clavate, 1–1.5cm long. *Fruit* c.2 × 0.6cm.

Bhutan: S – Phuntsholing district (Phuntsholing); **Sikkim** (Sembri?). In mixed evergreen forest; 500m. Fl. April–May.

GENERAL DISTRIBUTION. India, Myanmar, Thailand, S China, Laos, Vietnam, Malaysia, the Malay Archipelago to New Guinea, the Philippines and Australia.

ETYMOLOGY. From the Latin *plicatus* (folded) in reference to the leaves.

NOTE. A detailed discussion of the nomenclature of this species is given by Seidenfaden (1978a).

Section **Nervilia**

7. **N. aragoana** Gaudichaud, in Freycinet, Voy. Uranie: 422, t.35 (1826). Type: Guam (Mariannis), *Guaudichaud-Beaupré* s.n. (holo. P!).

Epipactis carinata Roxb., Hort. Bengal.: 63 (1814), *nom. nud.*; Fl. Ind. ed.1832, 3: 454 (1832). Type: India, Bengal, [icon. of] '*Arethusa carinata*' Roxburgh 2092 (holo. K!).

Pogonia carinata (Roxb.) Lindl., Gen. Sp. Orchid. Pl.: 414 (1840).

P. flabelliformis Lindl., op. cit. 415 (1840). Type: India, Sukanaghur, coll. *Buchanan-Hamilton* Wall. Cat. 7400A (holo. K-LINDL!, iso. K-W!).

P. nervilia Bl., Mus. Bot. 1: 32 (1849), *nom. alt.*

P. scottii Rchb. f. in Flora 55: 276 (1852). Type: India, Darjeeling, *Scott* s.n. (holo. not found).

P. gracilis Bl., Coll. Orchid.: 155, t.57, f.3 (1858). Based on icon. cited here.

Nervilia scottii (Rchb. f.) Schltr. in Bot. Jahrb. Syst. 45: 404 (1911).

N. yaeyamensis Hayata, Icon. Pl. Formos. 2: 140 (1912). Type from Taiwan.

N. tibetensis Rolfe in Notes Roy. Bot. Gard. Edinburgh 8: 128 (1913). Type: China, Xizang, Chamutang, *Kingdon-Ward* 151 (holo. E).

Aplostellis flabelliformis (Lindl.) Ridley, Fl. Malay. Penins. 4: 203 (1924).

Nervilia flabelliformis (Lindl.) T. Tang & F.T. Wang in Acta. Phytotax. Sin. 1: 68 (1951), *nom. illegit.*

Plant up to 40cm tall; *tuber* small, globose, 2–2.5cm across. *Leaf* petiolate, flabellate-reniform or flabellate-cordate, rounded at base, apiculate, plicate, 7–15 × 10–17cm; petiole elongate, 12–18cm long. *Inflorescence* hysteranthous, erect, subdensely many-flowered; peduncle enclosed in inflated sheaths below, distantly bracteolate above; rachis 7–10cm long; floral bracts linear-lanceolate, acuminate, reflexed, 1.5–2.5cm long. *Flowers* 1.4–3cm long; sepals and petals greenish-yellow, lip white or pink veined with purple; pedicel and ovary 0.6–1.5cm long. *Sepals* and *petals* similar, oblong-linear to linear-lanceolate, acuminate, 1.4–3cm long. *Lip* 3-lobed, base cuneate, 1.5–3cm long; lateral lobes ovate-triangular, acute or obtuse; mid-lobe ovate to ovate-triangular, acute, obtuse or rounded in front with undulate margins; disc more or less pubescent in middle. *Column* straight, clavate, 5–6mm long. *Fruit* ovoid to globose, stalked, 0.8–1 0.6–0.8cm; stalk 5–7mm.

Bhutan: S – Phuntsholing district (Phuntsholing); **Sikkim** (unlocalised Pantling specimen). In mixed forest of *Pinus* and *Quercus* sp.; 500–1000m. Fl. March–May.

GENERAL DISTRIBUTION. India, China (including Xizang), S and SE Asia, Malaysia, Indonesia, the Philippines, Timor, Samoa, Palau, New Guinea and Australia.

ETYMOLOGY. Named after Jacques Arago who was the artist on the expedition with Freycinet and Gaudichaud-Beaupré.

NOTES. Hooker (1890) called this plant *Pogonia flabelliformis* Lindl. and King & Pantling (1898) knew it as *Pogonia scottii* Rchb. f. The confused taxonomy of this species has been thoroughly reviewed by Seidenfaden (1978a) and we follow his conclusions here.

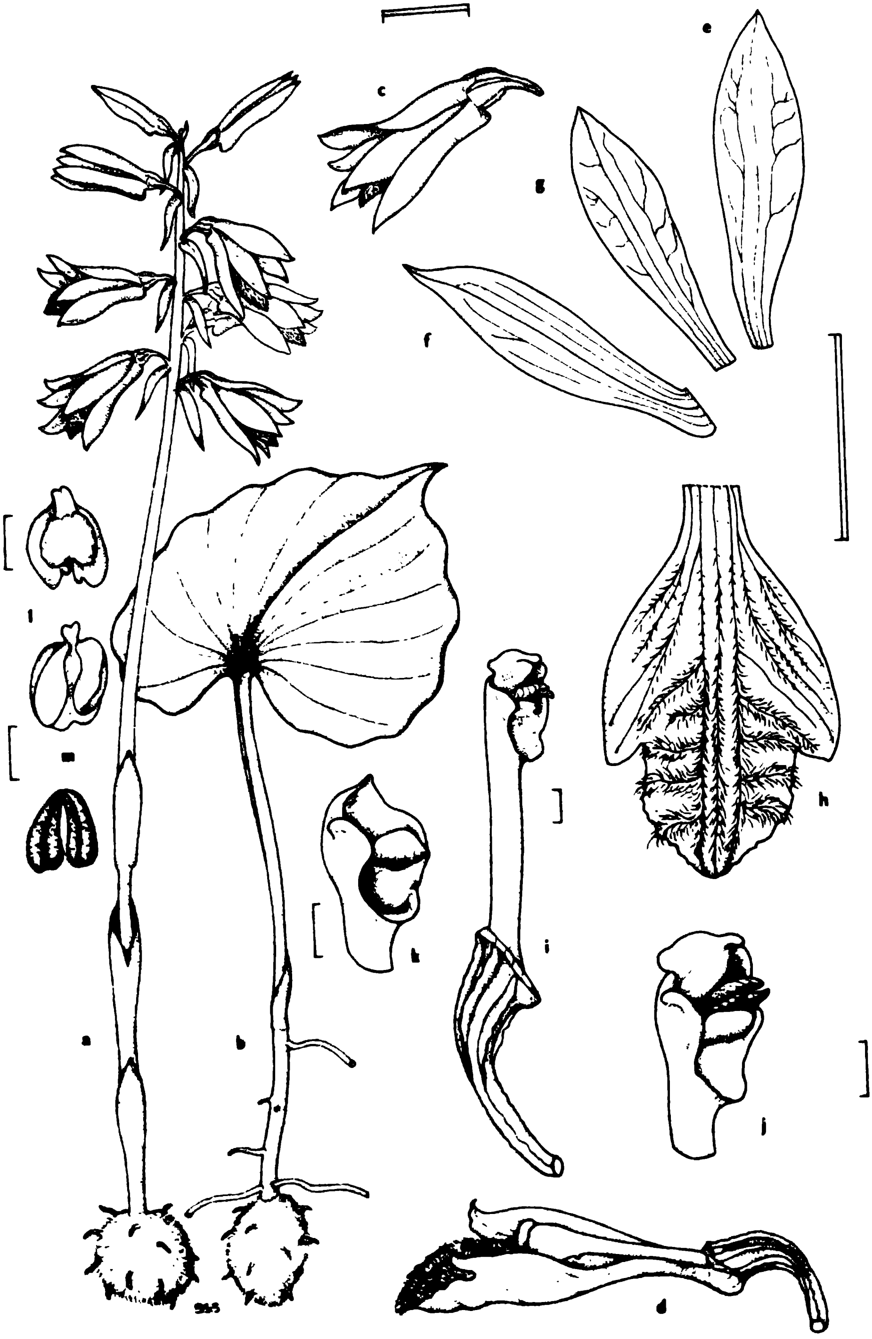


Fig. 13. *Nervilia gammieana*: a, habit (flowering); b, habit (leafing); c, flower; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column and ovary; j, column apex; k, column apex (with anther removed); l, anther (two views); m, pollinia. Drawn by Susanna Stuart-Smith, a–b from *Pantling* 310 (K); c–m from *Gammie* 6671 (K)

8. N. gammieana (Hook. f.) Schltr. in Bot. Jahrb. Syst. 45: 404 (1911). Type: India, Darjeeling, Gammie s.n. (holo. K!).
Pogonia gammieana Hook. f. in Bot. Mag. 109: t.6671 (1883).

Plant up to 20cm tall; *tuber* subglobose, tuberculate, up to 2cm across. *Stem* stout, green; sheaths 1–4, the lowest streaked with red-brown, 3.5–4.5cm long. *Leaf* petiolate, glabrous, orbicular-cordate, acuminate, margin undulate, basal sinus deep, veined, deep green above and pale below, 10–15 × 10–15cm; petiole cylindric, streaked with red-brown; sheath single, basal, obtuse, up to 9cm long. *Inflorescence* 6- to 8-flowered; rachis green, 6–8cm long; floral bracts linear, membranous, 0.5–1.4 × 0.2–0.3cm. *Flowers* 1.5–2cm long; sepals and petals pale lilac, streaked with pale pink, lip pale green to yellow, veined with darker green; pedicel and ovary turbinate, 6-grooved, very short, 3–7mm long. *Sepals* and *petals* subequal, elliptic-lanceolate, acuminate, 1.6–2.2 × 0.4–0.5cm. *Lip* 3-lobed, clavate, shortly clawed, 2–2.5 × 0.4–0.6cm; lateral lobes small, convolute around the column; mid-lobe orbicular, pubescent along veins. *Column* semi-terete, 6–8mm long; anther depressed-hemispheric, c.1.6mm long. **Fig. 13.**

Darjeeling (Rangit River, Kurseong); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). In pine forest; to 1000m. Fl. April–June.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after James Alexander Gammie (1839–1924) of the Sikkim Cinchona Plantations.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

N. juliana (Roxb.) Schltr. in Bot. Jahrb. Syst. 45: 402 (1911). Type: India, near Calcutta, [icon.of] '*Arethusa juliana*' Roxburgh 2091 (holo. CAL, iso. K!).
Epipactis juliana Roxb., Hort. Bengal.: 63 (1814), nom. nud.; Fl. Ind. ed. 1832, 3: 453 (1832).
Pogonia juliana (Roxb.) Lindl. in Wall. Cat.: 7399 (1832) nom. nud.; Gen. Sp. Orchid. Pl.: 414 (1840).

NOTE. Reported from Tipi in the W Kameng district of Arunachal Pradesh by Hegde & Rao (1983b).

Tribe **Vanilleae** Lindl.

Subtribe **Galeolinae** Garay

13. **Galeola** Loureiro

Plants mycotrophic, leafless, erect or scandent, growing from short rhizomes. *Inflorescence* racemose or paniculate. *Flowers* more or less fleshy. *Sepals* and *petals* similar, concave, sometimes connivent, rarely spreading. *Lip* sessile, fleshy, enveloping the column, entire or lobed; disc either papillose or with a callus. *Column* elongate, wingless; clinandrium thin-margined, entire or denticulate; anther incumbent; pollinia 2, 2-lobed. Fruit a fleshy pod.

The genus *Galeola* was established in 1790 by the Portuguese missionary and naturalist João de Loureiro in his *Flora Cochinchinensis*. The genus comprises about 20 species distributed in Madagascar, through India, Bhutan, Malaysia, Indonesia and Papua New Guinea to Australia.

The genus was split into two sections by Blume in 1825 but these were united by Bentham in 1883. Garay (1986a) has given Blume's section *Cyrtosia* generic status.

The pollination mechanism in the genus *Galeola* is unknown. The seeds are winged and are classified by Dressler (1993) as the *Galeola*-type.

TYPE. *Galeola nudifolia* Loureiro.
ETYMOLOGY. From the Latin *galea* (a soldier's helmet) in reference to the semi-open flower shape.

Key to species

1. Stems scandent; flowers not exceeding 2cm across 2
+ Stems erect, not scandent; flowers more than 3cm across 3

2. Sepals linear-oblong; lip cuneate at base .... **1. G. cathcartii**
+ Dorsal sepal oblong; lateral sepals obliquely ovate, weakly falcate; lip cordate at base .... **4. G. nudifolia**

3. Flowers more than 5cm across; anther smooth; capsule sharply 3-angled, falcate, more than 18cm long; rhizome more than 3cm thick .... **2. G. falconeri**
+ Flowers 3.5cm across; anther papillose; capsule obscurely 2-angled, 15–18cm long; rhizome less than 2.2cm thick .... **3. G. lindleyana**

1. G. cathcartii Hook. f., Fl. Brit. India 6(1): 89 (1890). Type: India, Sikkim, icon. Cathcart s.n. (holo. CAL, copy K!).
Galeola kerrii Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 409 (1925). Type from Thailand.
G. siamensis Rolfe ex Downie, *op. cit.* 410 (1925). Type from Thailand.

Plant scandent, to 9m tall, bearing roots at intervals. *Stem* branched, smooth, scurfy, c.1cm thick, arising from rhizome; with 1 or 2 oblong, coriaceous sheaths at base. *Inflorescence* paniculate, lateral, spreading or pendent; rachis up to 15cm long; floral bracts minute, triangular, 4–6 × 2mm. *Flowers* 1.5–2.5cm across; sepals and petals yellow, the lip with red lines on its basal half; pedicel and ovary subcylindric, 2–4cm long. *Sepals* similar, linear-oblong, subacute, recurved, scurfy outside, 1.8–2.2 × 0.3–0.45cm. *Petals* linear-oblong, smaller than the sepals, recurved, 1.8–2.5 × 0.2–0.35cm. *Lip* ovate to obovate when spread, concave, entire in its basal third, erose-lacinate in the upper third; upper surface papillose, with a small, oblong callus near the rounded apex, 1–1.6 × 0.9–1.1cm. *Column* clavate, c.8mm tall; clinandrium with denticulate margins; anther fleshy; pollinia mealy, elliptic. *Fruit* cylindric, scurfy, 15–21cm long.

Sikkim (locality unknown (Hooker, 1890)). Fl. June.

GENERAL DISTRIBUTION. NE India and Thailand.
ETYMOLOGY. Named after John Ferguson Cathcart (1802–1851), a Scottish botanist who worked for the Bengal Civil Service and engaged Indian artists to make botanical drawings.

2. G. falconeri Hook. f., Fl. Brit. India 6(1): 88 (1890). Types: India, Garhwal, icon. Falconer s.n. (syn. K!); India, Sikkim, Thomson s.n. (syn. K!).

Plant erect, to 3m tall; *rhizome* 3.5–6cm thick, branched, clothed in large, fleshy, triangular scales. *Stem* woody, terete, up to 2.5cm thick; sheaths lanceolate-triangular, acute, 2.5–5cm long. *Inflorescence* paniculate, branched, pendent, laxly flowered; floral bracts lanceolate, acute, concave, 1–2.5cm long. *Flowers* smelling of vanilla, spongy in texture, c.5 × 2cm; petals yellowish-brown on outside, bright yellow within; pedicel and ovary 2.5–5cm long. *Sepals* subequal, broadly ovate, subacute, sparsely scurfy, 2–2.5cm long. *Petals* ovate, acute, with erose margins, 2.-2.5cm long. *Lip* sessile, deeply concave, lacking lateral lobes, c.2 × 1.5cm; a small fold forming a pseudonectary at the base under the column; apex rounded, margins undulate-ciliolate; upper surface papillose with a broad, glabrous patch in the middle. *Column* stout, clavate, 0.6–1.4cm long. *Fruit* cylindric, 3-angled, weakly falcate, obscurely scurfy, 16–22 × 3.5–4cm. **Fig. 14p–t; Plate 4.**

Bhutan: S – Phuntsholing district (Phuntsholing); **N** – Upper Kuru Chu district (Tobrang to Trashi Yangsi Chu); **Darjeeling** (unlocalised *Clarke* and *Gamble* specimens); **Sikkim** (Tumlang). In dense broad-leaved forest; 1800m. Fl. May–July.

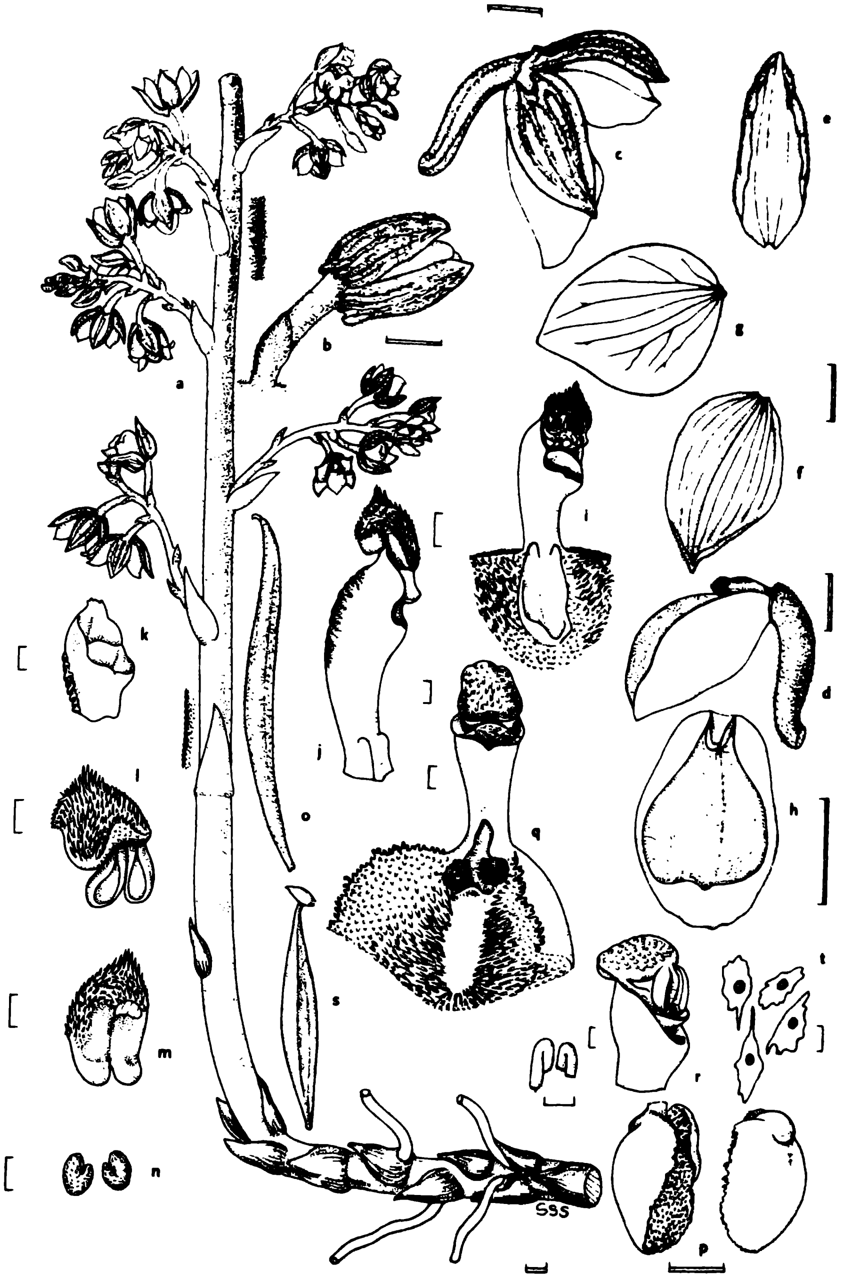


Fig. 14. **Galeola lindleyana**: a, habit; b, flower bud; c, flower; d, column, lip and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, lip base and column (detail); j, column; k, column apex; l, anther cap; m, anther cap; n, pollinia; o, fruit. **G. falconeri**: p, lip (two views); q, lip base and column (detail); r, column apex; s, fruit; t; seeds. Drawn by Susanna Stuart-Smith, a–o from *Grierson & Long* 2366 (E); p–r from *Ludlow et al.* 20857 (K); s–t from *Pantling* 378 (K).

GENERAL DISTRIBUTION. NE India to Thailand.
ETYMOLOGY. Named after Hugh Falconer (1808–1865), a Scottish botanist and superintendent of the Sabaranpur Botanic Garden between 1832 and 1842.

3. G. **lindleyana** (Hook. f. & Thomson) Rchb. f., Xenia Orchid. 2: 78 (1862). Type: India, Khasia, *Hooker* 357 (holo. K!).
Cyrtosia lindleyana Hook. f. & Thomson in Hook. f., Ill. Himal. Pl.: t.22 (1855).
Erythrorchis lindleyana (Hook. f. & Thomson) Rchb. f. in Bonplandia 5: 37 (1857).
Galeola lindleyana var. *unicolor* Handel-Mazzetti, Anz. Akad. Wiss. Wien. Math.-Naturwiss. Kl. 59: 253 (1922). Type: China, Yunnan, *Handel-Mazzetti* 9195 (holo. WU).
G. kwangsiensis Handel-Mazzetti in Sinensia 7: 620 (1936). Type: China, *Handel-Mazzetti* (holo. WU).

Plant erect, to 2m tall; *rhizome* reddish, clothed in large cordate, fleshy scales, c.2.2cm thick. *Stem* reddish, scurfy; bearing numerous short, acute sheaths in the basal half. *Inflorescence* paniculate, laxly few-flowered; branches pendent; floral bracts sessile, ovate, withering as the flowers develop, c.3mm long. *Flowers* subglobose, thick, spongy, up to 3.5cm across; sepals and petals bright yellow with a reddish patch on the lip at each side of the column, anther crimson; pedicel and ovary cylindric, pubescent, 1–1.9cm long. *Sepals* subequal, with denticulate external ribs; *dorsal sepal* elliptic-oblong, subacute, 1–3 × 1.3–1.5cm; *lateral sepals* elliptic, acute, c.3.4 × 2.1cm. *Petals* broadly ovate, obtuse, margins ciliate, exceeding the sepals, 1.1–3.6 × 2.4–2.6cm. *Lip* simple, cup-shaped, obscurely 3-lobed, 0.9–1.9cm long; upper surface papillose; disc lamellate, margins ciliate. *Column* clavate, with 2 erect, granular processes near the base, 7–8mm long. *Fruit* cylindric, subtrigonous, bluntly apiculate, 15–18cm long. **Fig. 14a–o; Plate 4.**

Bhutan: C – Punakha (Tashithang, near Wangdi Phodrang) and Mongar (Kori La, E of Mongar) districts; **Darjeeling** (Mongpu); **Sikkim** (below Damthang, 5km NW of Gangtok, Lachung, Singhik, Tendong). In mossy evergreen *Quercus* forest, commonly growing beside tree stumps in clearings; 1500–3600m. Fl. June–July.

GENERAL DISTRIBUTION. NE India, China to SE Asia and Sumatra.
ETYMOLOGY. Named after John Lindley (1799–1865), the English botanist who contributed so greatly to the study of orchids and was founder of the *Gardener's Chronicle*.

4. G. **nudifolia** Loureiro, Fl. Cochinch.: 2: 520 (1790). Type: Vietnam (Cochinchina), *Loureiro* s.n. (holo. BM!).
Epidendrum galeola Raeuschel, Nomencl. Bot. ed.3: 265 (1797), *nom. nov.*
Cranichis nudifolia (Loureiro) Persoon, Syn. Pl. 2: 511 (1807).
Vanilla pterosperma Lindl., in Wall. Cat.: 7402 (1832), *nom. nud.*
Erythrorchis kuhlii Rchb. f., Xenia Orchid. 2: t.119 (1862). Type: based on [icon.] t.119 cited here.
Galeola hydra Rchb. f., *op. cit.* 77 (1865). Type from Malaysia.
G. kuhlii (Rchb. f.) Rchb. f., *op. cit.* 78 (1865).
G pterosperma (Lindl.) Schltr. in Bot. Jahrb. Syst. 45: 386 (1911).

Plant scandent. *Stems* stout, scurfy, puberulous, branched; sheaths few, scattered, fleshy, ovate-boat-shaped, unequal. *Inflorescence* racemose, laxly flowered, up to 10cm long; floral bracts fleshy, acute, 0.9–1.1cm long. *Flowers* up to 2.2cm long; yellow with red markings on the lip and anther; pedicel and ovary exceeding floral bracts, 0.8–1.8cm long. *Sepals* subequal, c.1.1cm long; *dorsal sepal* oblong, subacute; *lateral sepals* obliquely ovate, weakly falcate, acute. *Petals* shorter than sepals, lower edge rounded, upper edge undulate, c.9mm long. *Lip* suborbicular, concave, cordate at the base, edges erose-fimbriate, entire, 0.7–1cm long; upper surface papillose-pubescent; disc with a smooth, elongate callus towards the base. *Column* curved, c.4mm long; anther ribbed. *Fruit* cylindric, 13–23 × c.2cm.

Bhutan: S – Gaylegphug district (Gaylegphug (M.F.B.)); **Sikkim** (Namphak, Tista River). In evergreen forest, climbing on tall trees; 500m. Fl. (April–)May–July.

GENERAL DISTRIBUTION. N India, Myanmar, Vietnam, Malaysia, the Philippines, Java and Sumatra.
ETYMOLOGY. From the Latin nudus (lacking) and *folium* (leaf).

Subtribe **Lecanorchidinae** Dressler

14. **Lecanorchis** Bl.

Plants mycotrophic, leafless, terrestrial; *rhizome* scaly, rough, more or less J-shaped; *roots* numerous, radiating. *Stem* simple or branched, erect, hard, slender, sheathed. *Inflorescence* terminal, racemose, laxly few-flowered. *Flowers* small; ovary slender, elongate, with a shallow, campanulate, denticulate calyculus encircling the base of the perianth. *Sepals* and *petals* free, similar. *Lip* more or less adnate at the basal margins to the column, forming a basal tube, simple to 3-lobed; tube with unicellular hairs; apex with ribbon-like, multicellular hairs. *Column* slender, elongate, more or less clavate; clinandrium high; lateral stigma lobes forming an erect plate, papillose; anther incumbent; pollinia in 2 friable masses.

The genus *Lecanorchis* was established by in 1856 Carl Blume in his *Museum Botanicum Lugduno-Batavum*. The genus comprises about 15 species distributed in Sikkim, Japan (Honshu) to Java and Papua New Guinea.

LECTOTYPE. *Lecanorchis javanica* Bl.
ETYMOLOGY. From the Greek *lecano-* (a dish, pelvis) and *orchis* (a testicle, a Greek name for orchids) in reference to the pelvis-like calyculus.

1. **L. sikkimensis** N. Pearce & P. J. Cribb in Edinb. J. Bot. 56(2): 280 (1999). Type: India, Sikkim, above Rungbee (Rimbi Chhu), *Prain's collector* s.n. (holo. K!).

Plant 35–45cm tall; *rhizome* coiled, woody, c.3mm thick. *Stem* erect, slender, ridged, narrowed towards apex, glabrous, 35–45 × c.0.15cm; basal half covered with glabrous, tubular sheaths, 1–2cm long; upper part with distant, deltoid, acute, glabrous bracts, c.9mm long. *Inflorescence* laxly 3- to 5-flowered; floral bracts short, ovate, acute, glabrous, 3–4mm long. *Flowers* campanulate, semi-open, 1–1.4cm long; sepals and petals dull purple, lip with a pale yellow mid-lobe and dull purple lateral lobes; pedicel and ovary narrow, dull purple, 1.5–3 × 0.5cm; calyculus erose-denticulate. *Sepals* subsimilar; dorsal sepal oblong, obtuse, 1.2–1.5 × 0.3–0.4cm; lateral sepals oblong-oblanceolate, obtuse, c.1.5 × 0.4cm. *Petals* clavate, obtuse, 1.3–1.5 × 0.3–0.4cm. *Lip* 1–1.2 × 0.6cm; base tubular, softly hairy, attached to the column for about half its length; apex 3-lobed, 5-veined, lateral lobes broadly triangular to subquadrate, edges erose-denticulate, mid-lobe densely hairy, hairs retroflexed; disc ecallose. *Column* erect, slender, clavate, connate with the base of the lip, 6–7mm long; column wings rectangular; stigma central, projecting; pollinia 2. **Fig. 15**; **Plate 4**.

Bhutan: – Tashigang district (near Tashi Yangtsi); **Sikkim** (above Rimbi Chhu). River valleys, in shade; 1980–2100m. Fl. May–June.

GENERAL DISTRIBUTION. E Himalaya.
ETYMOLOGY. From Sikkim, where the type specimen was collected in 1902.
NOTE. This is the first record of this species outside Sikkim.

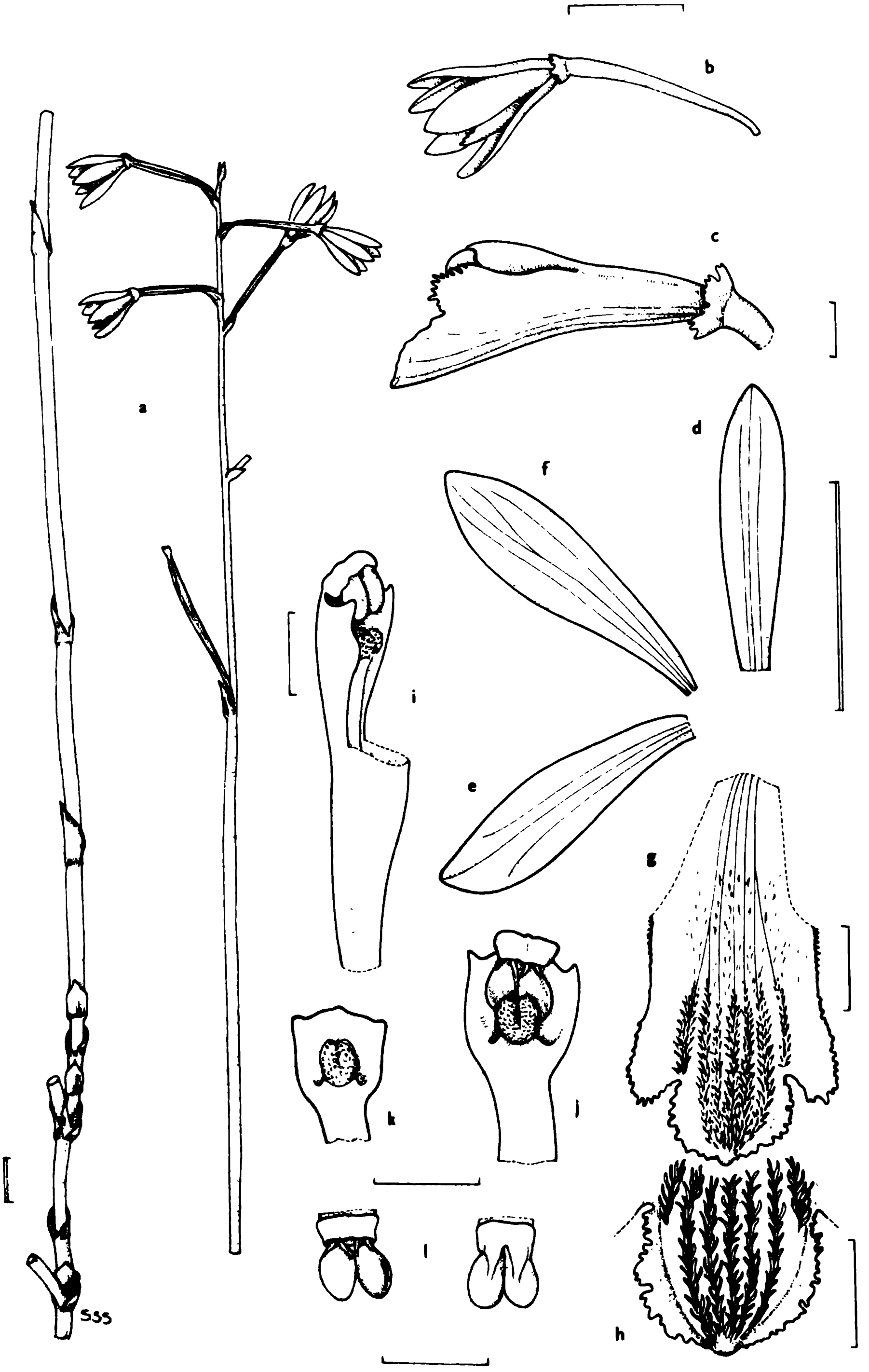


Fig. 15 ***Lecanorchis sikkimensis***: a, habit; b, flower and ovary; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip (detail of apex); i, column; j, column apex; k, column apex (anther removed); l, anther (two views). Drawn by Susanna Stuart-Smith from *Prain's collector* s.n. (K). Single bar line = 0.5mm

Subfamily **SPIRANTHOIDEAE** Dressler

Tribe **Tropideae** Dressler

15. **Corymborkis** Thouars

Plants terrestrial, up to several metres tall; *roots* fasciculate, fibrous. *Stem* erect, sometimes branched, leafy. *Leaves* large, plicate, sheathing at base. *Inflorescences* axillary, racemose or paniculate, few- to many-flowered. *Flowers* resupinate, somewhat tubular, distichous. *Sepals* and *petals* spreading, linear-spathulate, basally connivent or connate to form a shallow cup or tube. *Lip* erect, linear, channelled with recurved apex. Column long, slender, clavate; anther dorsal; rostellum bifid; pollinia 2, sectile, obovoid, stipe hamular; viscidium peltate.

The genus *Corymborkis* was proposed in 1809 by the French botanist L.-M. A. Aubert du Petit-Thouars in his *Extrait de Trois Mémoires* and later in *Histoire Particulière* in 1822. An extensive revision of the genus was published by Rasmussen (1977) and a review of the two alternative systems of nomenclature used by Thouars can be found in Friis & Rasmussen (1975). The genus comprises about eight species distributed widely in pantropical regions.

Rasmussen (1977) suggested that syrphid flies may act as pollinators, visiting the flowers in search of food and attracted to the flower by the lip acting as a 'flag'. This syndrome was called myophily by van der Pijl & Dodson (1966). However, P.J. Cribb has observed visits to *C. veratrifolia* by a sphingid moth in Java.

TYPE. *Corymborkis corymbosa* Thouars.
ETYMOLOGY. From the Greek *corymbos* (a cluster of flowers) and *orchis* (testicle) in reference to the corymb-like inflorescence of the type species.

1. **C. veratrifolia** (Reinwardt) Bl., Coll. Orchid.: 125, t.42e, 43i (1859). Type: Java, without precise locality, T. Lobb 162 (neo. K!; iso-neo. BM!, C (photo.)), designated by Rasmussen in Bot. Tidsskr. 71: 170 (1977).

Rhynchanthera paniculata Bl., Tabel. Pl. Jav. Orch.: t.16, f.78 (1825), nom. nud.
Hysteria veratrifolia Reinwardt in Syll. Pl. Nov. 2: 5 (1826).
Corymborkis assamica Bl., Coll. Orchid.: 126, t.43, f.2A/B(1859). Type: India, Assam, Jenkins s.n. (lecto. L!), designated by Rasmussen in Bot. Tidsskr. 71: 170 (1977).

Plant up to 1m tall, often forming clumps. *Stem* terete, woody, leafy. *Leaves* plicate, elliptic to oblong-elliptic, acute to acuminate, sheathing at base, 15–50 × 3–14cm; sheaths 5–6cm long. *Inflorescence* 2- to 9-branched, erect or spreading, sometimes pendent, many-flowered; peduncle often flattened, hidden in leaf sheaths, up to 14cm long; floral bracts ovate-lanceolate, hooded, acute, 0.3–1.1cm long. *Flowers* variable in size, spreading, fragrant, tubular or campanulate, uniformly white or pale green; pedicel and ovary c.1.5cm long. *Sepals* linear-lanceolate, acute, spreading, 1.6–5.3 × 0.25–0.6cm. *Petals* oblong-lanceolate, acute, curved outwards, c.5 × 0.2–0.8cm. *Lip* long-clawed, 4.8–5.2 × 1.4–1.6cm (across apical lobe when spread); apical lobe suborbicular, margins undulate-erose, curved or deflexed, mucronate at apex; callus with 2 fleshy, divergent ridges onto the base of the apical lamina. Column cylindric, 7–8.5mm long; rostellum 2-horned, 3–4mm long; pollinaria c.6mm long. **Fig. 16.**

Sikkim (unlocalised *Hooker* and *Pantling* specimens). In lowland to tropical montane valleys, in deep shade; 600–2000m. Fl. July.

GENERAL DISTRIBUTION. India, China, Thailand, Malaysia, Japan, Malay Archipelago, the Philippines and Australia.
ETYMOLOGY. From the the white hellebore (*Veratrum album* L.) which has similar leaves.
NOTE. A full synonymy can be found in Rasmussen (1977).

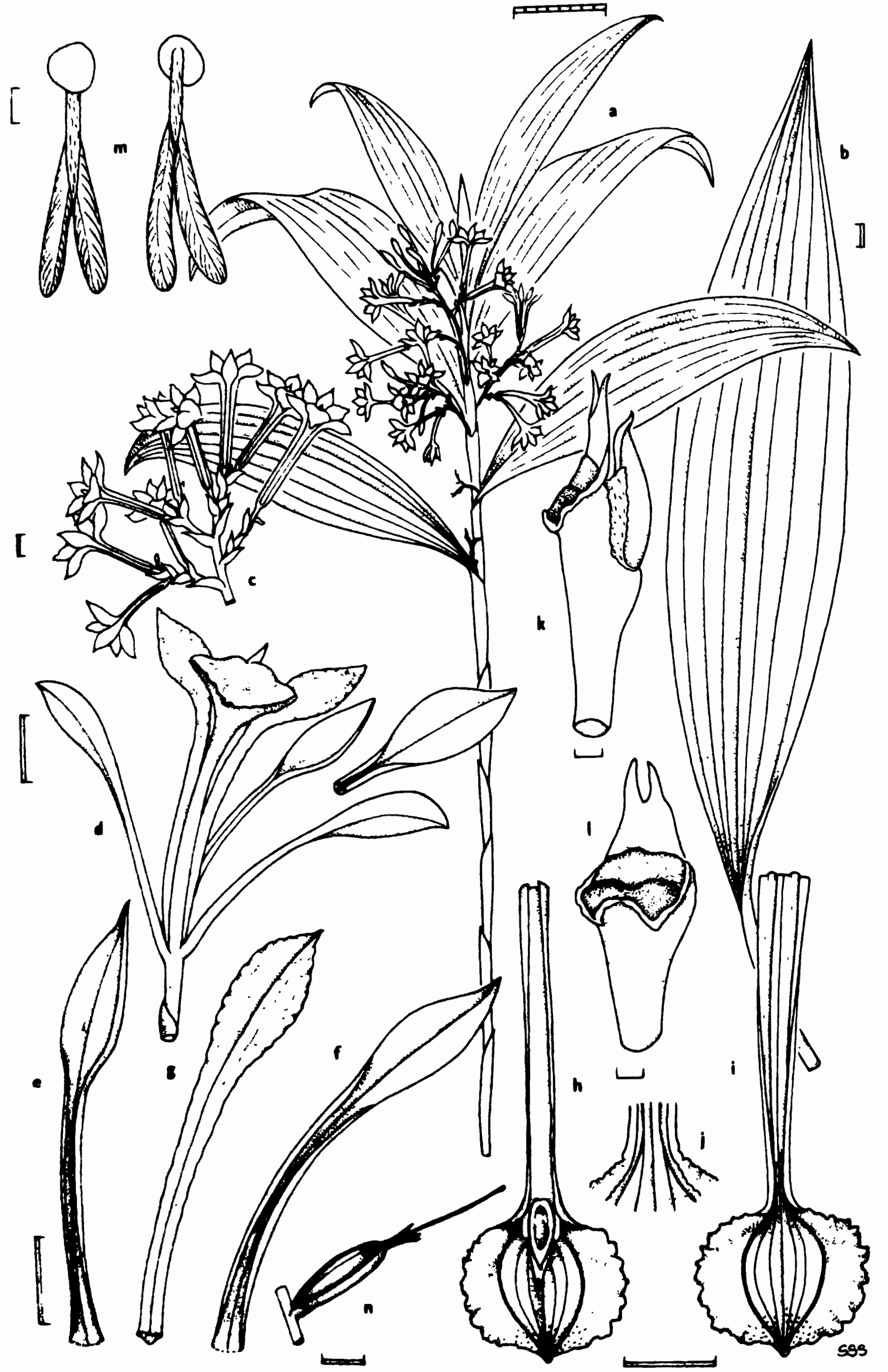


Fig. 16. **Corymborkis veratrifolia**: a, habit; b, leaf; c, inflorescence (detail); d, flower; e, dorsal sepal; f, lateral sepal; g, petal; h, lip with column; i, lip (with column removed); j, lip (detail when flattened); k, column (side view); l, column (front view); m, pollinarium (two views); n, fruit. Drawn by Susanna Stuart-Smith, a–b from *Pantling* 475 (K), c–m from cult. Dennis (K); n from *Hooker* 1867 (K).

16. **Tropidia** Lindl.

Plants terrestrial, with fibrous, fasciculate roots. *Stem* branched, or superposed, erect. *Leaves* sheathing. *Inflorescence* terminal, racemose. *Flowers* non-resupinate, small. *Sepals* connivent, free; lateral sepals more or less connate. *Petals* free. *Lip* sessile, entire or lobed, basally saccate or gibbous; often with a spur. *Column* short; clinandrium thin-margined; anther erect, dorsal; pollinia 2, granulose; rostellum prominent.

The genus *Tropidia* was established in 1833 by John Lindley in the *Botanical Register*. The genus comprises about 20 species distributed from C America, the W Indies and Florida to Asia, India, Malaysia and the adjacent islands.

TYPE. *Tropidia curculigioides* Lindl.
ETYMOLOGY. From the Greek *tropidios* (a ship's keel) in reference to the conduplicate, dorsally keeled lip of some species.

Key to species

1. Leaves broadly elliptic-ovate; peduncle more than 2cm long; lip with a spur .... **1. T. angulosa**
+ Leaves oblong-elliptic; peduncle less than 1.5cm long; lip spurless .... **2. T. curculigioides**

1. T. angulosa (Lindl.) Bl., Coll. Orchid.: 122 (1859). Types: ?India, Mt. Sylhet, coll. *W. Gomez* Wall. Cat. 7388 (syn. K-LINDL!, isosyn. K-W!); India, Courtallum, *Wight* 928 (syn. K-LINDL!).
Decaisnea angulosa Wall., Numer. List: 7388 (1832), nom. nud.
Cnemidia angulosa Lindl., Gen. Sp. Orchid. Pl.: 463 (1840).
C. semilibera Lindl., loc. cit. (1840). Type: India, *Wallich* s.n. (holo. K-LINDL!).
Govindovia nervosa Wight, Icon. Pl. Ind. Orient 6: 2090 (1853). Type: India, Courtallum, *Wight* 928 (holo. K-LINDL!).
Tropidia govindovii Bl., Coll. Orchid.: 122 (1858), nom. alt.
T. semilibera (Lindl.) Bl., loc. cit. (1858).
T. calcarata Ames in Philipp. J. Sci., C 7: 7 (1912). Type from the Philippines.
T. somai Hayata, Icon. Pl. Formos. 6: 85, t.13 (1916). Type from Taiwan.
T. bellii Blatter & McCann in J. Bombay Nat. Hist. Soc. 35: 730 (1932). Type: India, Kanara, *Bell* 2992 (holo. BLAT).

Plant up to 30cm tall. *Stem* slender, terete; sheathing bracts up to 5, distant along the stem, obtuse, 1–3cm long. *Leaves* 2, at apex of stem, broadly elliptic-ovate, acuminate, plicate, with sheathing bases, 8–14 × 4–7.5cm. *Inflorescence* subglobose to conical, dense, up to 10-flowered; peduncle with numerous linear, spreading bracts, 3–4cm long; rachis 3–5cm long; floral bracts linear-lanceolate, caudate, acute to acuminate, decurved, 0.7–1.4cm long. *Flowers* up to 2cm long, uniformly white, flushed with pale yellow-ochre; pedicel and ovary sessile, 1–1.5cm long. *Sepals* subequal, oblong-lanceolate, acute, 3-veined, 0.8–1.1 × 0.18–0.21cm; *lateral sepals* connate almost to bifid apex. *Petals* oblong-ovate, acute, 5-veined, 0.7–1.1 × 0.2–0.3cm. *Lip* oblanceolate-oblong, obtuse, entire, concave to base, adnate to the column, 0.7–1.1 × 0.35–0.45cm; spur basal, blunt, cylindric, parallel to the column, 4–6mm long. *Column* 2.5–3mm long; rostellum long-lanceolate, acuminate, 4–5mm long. *Fruit* clavate-cylindric, ridged, c.2cm long. **Fig. 17.**

Bhutan: C – Punakha (Dawakha) and Tongsa (Tingtinbi) districts; **Darjeeling** (Rayeng); **Sikkim** (Tista River). In heavy shade under semi-evergreen broad-leaved forest, in moist valleys, on leaf-litter; 300–1500m. Fl. September–November; Fr. January.

GENERAL DISTRIBUTION. India, Bangladesh, Myanmar, China, Thailand, Vietnam, Malaysia and Sumatra.
ETYMOLOGY. From the Latin *angulosus* (having an angle, angular) in reference to the branching habit of the species.

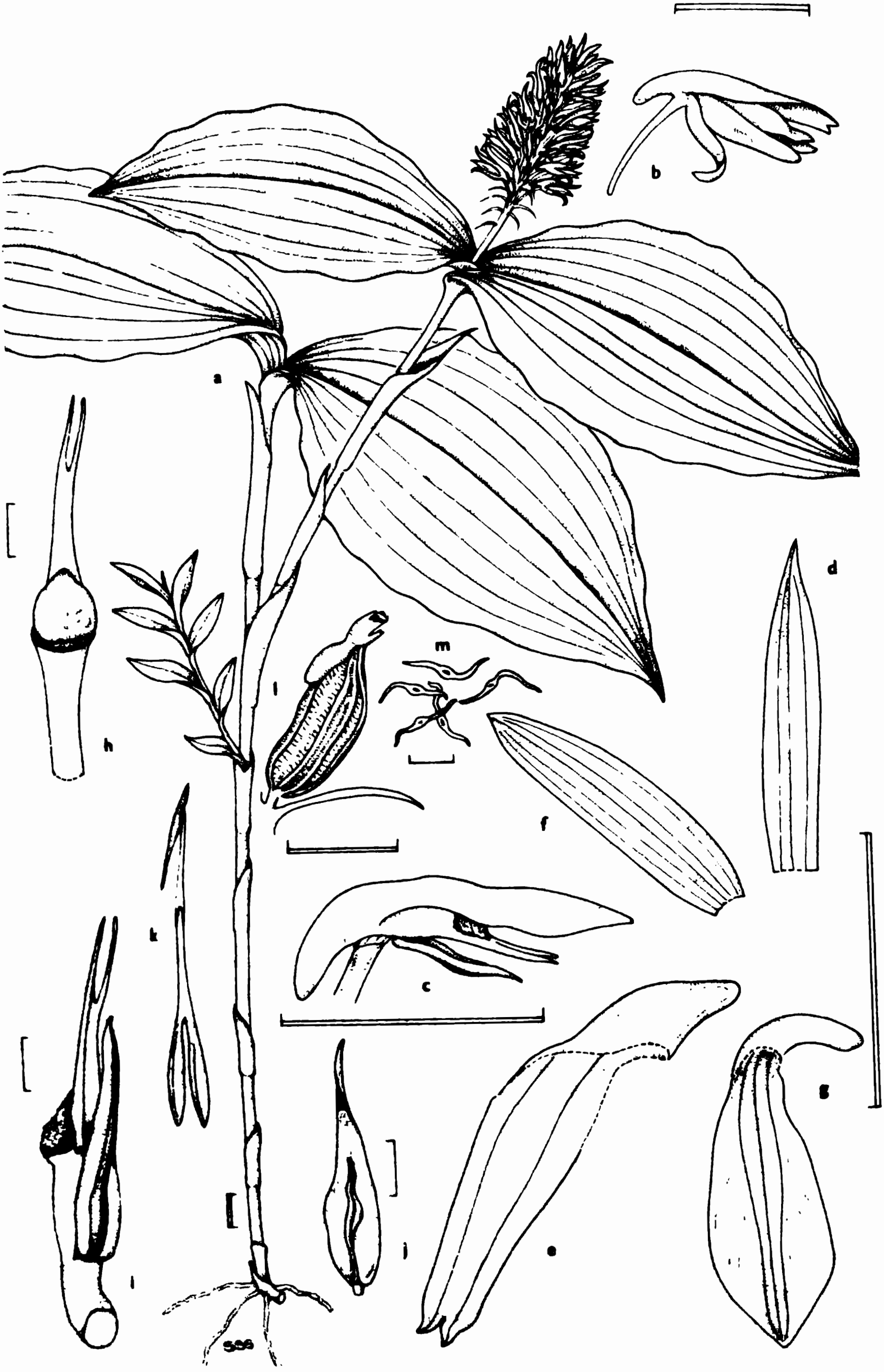


Fig. 17 *Tropidia angulosa*. a, habit; b, flower; c, lip and column; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (front view); i, column (back view); j, anther cap; k, pollinarium; l, fruit; m, seeds. Drawn by Susanna Stuart-Smith, a–k from *Pantling* 349 (K), l–m from *Mooney* 363 (K).

2. T. curculigioides Lindl., Gen. Sp. Orchid. Pl.: 497 (1840). Types: ?India, Mt. Sylhet, coll. *F. De Silva & W. Gomez* Wall. Cat. 7386A (syn. K-LINDL!, isosyn. K-W!, K!); Sri Lanka (Ceylon), *Macrae* 58 (syn. K-LINDL!).

Tropidia squamata Bl., Fl. Javae nov. ser.: 123, t.41, f.1 (1859). Type from Borneo.

T. assamica Bl., Fl. Javae. nov. ser.: 124, t.41, f.2 (1858). Type: India, Assam, *Griffith* 5340 (holo. K!).

T. hongkongensis Rolfe in J. Linn. Soc., Bot. 36: 40 (1903). Type: China, Hong Kong, *Champion* 522 (holo. K!).

T. graminea Bl., Fl. Javae nov. ser.: 124, t.41, f.3 (1859). Type from Java.

T. formosana Rolfe in Ann. Bot. (Oxford) 9: 158 (1895). Type from Taiwan.

Schoenomorphus capitatus Gagnepain in Bull. Soc. Bot. France 80: 351 (1933). Type from Laos.

Plant erect, up to 60cm tall. *Stem* slender. *Leaves* oblong-elliptic, tapering, acute to acuminate, sessile with sheathing base, plicate, 8–20 × 1–3cm. *Inflorescence* leaf-opposed, subglobose, densely flowered; peduncle bracteate, c.1.5cm long; floral bracts ovate-lanceolate, acute to acuminate, 7–9mm long. *Flowers* scurfy-pubescent, up to 8mm long, white, tinged with pale yellow, anther deep yellow; pedicel and ovary sessile, 3–4mm long. *Sepals* subequal, lanceolate, acuminate, sub-connivent, 4–5mm long. *Petals* similar to sepals, midrib on outer surface stout, falcately ovate-lanceolate, 4–5mm long. *Lip* narrowly oblong, tapering to apex, concave, adnate to column, bigibbous at base, lacking lateral lobes, 5–6mm long; apex decurved; upper surface with ridges in middle; spurless. *Column* stout, c.2mm long; clinandrium triangular; pollinia 2, elliptic. *Fruit* ovoid, 1–1.8 × 0.7–0.8cm.

Darjeeling (Buxa); **Sikkim** (locality unknown). In forests; 300–800m. Fl. May.

GENERAL DISTRIBUTION. Sri Lanka, NE India, Bangladesh, Myanmar, China (Yunnan), SE Asia, Malaysia, Java, Timor and Borneo.

ETYMOLOGY. From *Curculigo* (a genus in the Hypoxidaceae) and the Greek suffix *-oides* (indicating a resemblance).

NOTE. We follow Mansfeld (1934), Backer & Bakhuizen (1968), Comber (1990) and Averyanov (1994) for the synonymy of this species.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

T. pedunculata Bl., Coll. Orchid.: 122, t.40 (1858). Types: Sumatra, Padang, *Korthals* s.n. (syn. L! Herb. no. 903162845, isosyn. K!); Sumatra, Palembang, *Praetorius* s.n.(syn. BO).

NOTE. Reported by Rao (1995b) from Munna Camp in the W Kameng district of Arunachal Pradesh.

Tribe **Cranichideae** Endlicher

Subtribe **Goodyerinae** Klotzsch

17. **Anoectochilus** Bl.

Plants terrestrial. *Stems* ascending to erect, with decumbent rhizome, rooting at nodes. *Leaves* cauline, few, petiolate, usually clustered at base in rosette, dark velvet-green with white reticulations, purplish beneath. *Inflorescence* a laxly flowered raceme. *Flowers* showy. *Sepals* and *petals* free; lateral sepals spreading, oblique; petals connivent with dorsal sepal to form a hood. *Lip* 3-lobed, adnate to column base, spreading; hypochile spurred or saccate, broadly conical to cylindric, extending beyond the lateral sepals; mesochile channelled, lobulate, densely fimbriate to toothed; epichile with divergent, 2-lobed blade; spur with 2 short, broadly peltate glands. *Column* short, fleshy in front, with a pair of parallel wings or keels, elongate; rostellum prominent, not twisted; clinandrium cup-shaped, membranous; anther versatile; stigmas 2, lateral; pollinia 2, glandular.

The genus was established in 1825 as *Anecochilus* by Carl Ludwig Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*, but in 1828 he altered the spelling to *Anoectochilus* in his *Flora Javae et Insularum Adjacentium*. However, this latter spelling has been conserved over the earlier one. The genus comprises about 25 species distributed in tropical Asia, Malaysia, Polynesia and adjacent islands.

The circumscription of this difficult genus has been the source of great confusion over the years. Some authors (Lin & Hsu, 1976; Ormerod, 1995) have recognised both *Anoectochilus* and *Odontochilus* while others (Holttum, 1964; Brieger, 1974; Seidenfaden, 1978a) have included the latter in *Anoectochilus*. Neither position satisfactorily resolves the taxonomic problems, and Seidenfaden (1978a) concluded that 'undoubtedly a much fuller study of every single species in these genera must be undertaken' before their status is clear. Ormerod (pers. comm.) suggests that he has found clear and consistent differences between them (see generic key) and concludes that they should be treated as distinct; we follow this position here.

TYPE. *Anoectochilus setaceus* (Bl.) Lindl.; basionym: *Anecochilus setaceus* Bl.
ETYMOLOGY. From the Greek *anoectos* (open) and *cheilos* (a lip).

Key to species

1.	Sepals and petals olive-green and white; mesochile margins shortly toothed ..	**1. A. brevilabris**
+	Sepals and petals pink-white; mesochile margins long-fimbriate	**2. A. roxburghii**

1. A. brevilabris Lindl., Gen. Sp. Orchid. Pl.: 499 (1840). Type: India, Assam, *Mack* s.n. (holo. K-LINDL!).

Anoectochilus griffithii Hook. f., Fl. Brit. India 6(1): 96 (1890); Icon. Pl. 22: t.2159 (1893). Types: E Himalaya, *Griffith* 5344 (syn. K!); India, Assam, *Prain* 10 (syn. K!).

A. sikkimensis King & Pantling in J. Asiat. Soc. Bengal 65(2): 124 (1896). Types: India, Sikkim, *Pantling* 285A (syn. BM! CAL W!); Sikkim, *Pantling* 285B (syn. BM! CAL L!).

A. brevilabris var. *gigantea* Pradhan, Indian Orch.: Guide Identif. & Cult. 1: 122 (1976), nom. *inval.*, **syn. nov.**

Plant 6–40cm tall. *Stem* decumbent, glabrous, up to 3mm wide. *Leaves* 3–5(–8), clustered at base of stem, petiolate, elliptic-ovate, acute, dark green with yellow reticulations, 3–12 × 1.5–10cm; petiole expanded at base to form a sheath, 0.8–2cm long. *Inflorescence* densely 6- to 40-flowered; peduncle glandular-pubescent, 5–16cm long, with 3 sheathing, lanceolate, acuminate, bracts; bracts 1–2 × c.0.5cm (at the base); rachis 4–10cm long; floral bracts lanceolate, acuminate, 0.6–1.1cm long. *Flowers* up to 1.5cm long; sepals olive-green and white, lip white, mesochile teeth green; ovary sessile, 0.6–1.2cm long. *Dorsal sepal* oblong, obtuse, concave, 4–6 × 2–3mm; *lateral sepals* spreading, oblong, acute, 4–5 × 1.5–3mm. *Petals* asymmetric, inner margin straight, outer margin dilated, 3–5 × 1.5–3mm. *Lip* spurred, 8–9 × 5–7mm (at epichile, when spread); mesochile with 4 pairs of short teeth; epichile with 2 terminal, divergent, wedge-shaped lobes; spur short, pouch-like, bifid, calluses oval within, c.2mm deep. *Column* c.2mm long; rostellum large, ovate, resting on a large, forked process. *Fruit* up to 1.4 × 0.5cm.

Sikkim (unlocalised *Pantling* specimens). 900–1500m. Fl. & Fr. August.

GENERAL DISTRIBUTION. E Himalaya.
ETYMOLOGY. From the Latin *brevis* (short) and *labrum* (a lip).
NOTES. Hooker (1890), under his description of *A. brevilabris*, treated *A. albolineatus* Parish & Rchb. f. as conspecific, citing the type collections of this species (Tenasserim, Moulmein, *Parish* 325, K, W). We

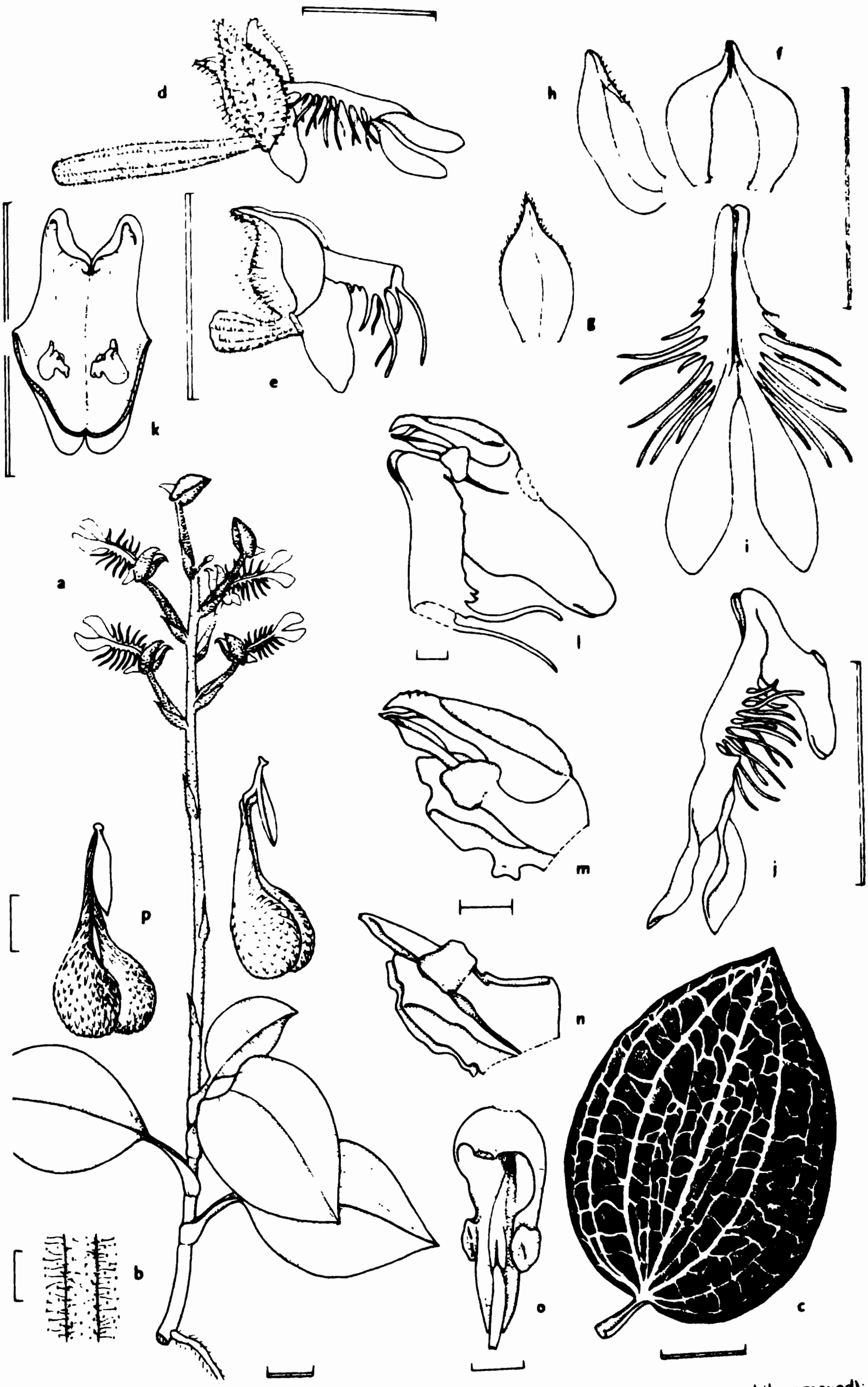


Fig. 18. **Anoectochilus roxburghii**: a, habit; b, peduncle (detail); c, leaf; d, flower; e, flower (epichile removed); f, dorsal sepal and petals; g, dorsal sepal; h, lateral sepal; i, lip; j, lip and spur (side view); k, lip base (detail); l, lip and column (side view); m, column (side view); n, column (with anther detached); o, anther cap; p, pollinarium (two views). Drawn by Susanna Stuart-Smith, a from *Ward* 8719 (K), b–p from cult. Kew A191 (K).

disagree: *A. brevilabris* has an obliquely hatchet-shaped epichile and shortly fringed mesochile, while *A. albolineatus* has an undivided epichile and a long-fringed mesochile.

Pradhan (1976) described var. *gigantea* but the name is invalid, lacking a Latin descripion. He commented that this variety was 'a very superior plant differing in no way from *A. brevilabris* Lindl. in floral structure, it was collected from S Bhutan at 1500m'. Pradhan (pers. comm.) now feels that this probably does not warrant varietal status and we therefore include it in synonymy here.

2. A. roxburghii (Wall.) Lindl., Gen. Sp. Orchid. Pl.: 499 (1840). Types: ?India, Mt. Sylhet, coll. F. *De Silva* Wall. Cat. 7387 (syn. K-LINDL!, isosyn. K-W! K!); E India Company, icon. Wallich 34 (syn. K!).
Chrysobaphus roxburghii Wall., Tent. Fl. Nepal: 37, t.27 (1826).
Anoectochilus yungianus Hu in Quart. J. Taiwan Mus. 23 (3–4): 257 (1971). Type: China, Hong Kong, S.Y. Hu 11001 (holo. HK).
Zeuxine roxburghii (Lindl.) Hiroe, Orchid Flowers 2: 68 (1971), **syn. nov.**

Plant up to 30cm tall. *Leaves* petiolate, ovate to ovate-oblong, acute, in a basal rosette, velvety, purplish-red with golden reticulations, 3–7 × 2–5.5cm wide; petiole expanded at base, glabrous, 0.5–1cm long. *Inflorescence* laxly 2- to 15-flowered; peduncle glandular-pubescent, 15–20cm long, with 3 to 5 oblong sheathing bracts; rachis 6–15cm long; floral bracts lanceolate, acute, glandular hairy, 0.5–1.7cm long. *Flowers* resupinate, up to 2cm long; sepals and petals pale pink-white, lip white; pedicel and ovary glandular-pubescent, 1–1.5cm long. *Sepals* subequal, glandular-pubescent externally, 0.4–1 × 0.2–0.4cm; *dorsal sepal* broadly ovate, acuminate, apex recurved; *lateral sepals* oblong, acute. *Petals* obliquely oblanceolate, acute, apices hooked, 4–7mm long. *Lip* 3-lobed, 1–2cm long; hypochile spurred, with 2 calluses; mesochile irregularly toothed; epichile 2-lobed, lobes linear-oblong, obtuse, recurved; *spur* tapering to a minute, 2-lobed apex, with 2 large warty glands, 4–5mm long. *Column* stout, with 2 large basal appendages, 2–4.3mm long; stigmas 2, elliptic; rostellum ovate, fleshy; pollinaria 8–9mm long. **Fig. 18.**

Bhutan: (unlocalised *Griffith* specimen); **Darjeeling** (Cinchona Plantation, Jaldhaka valley); **Sikkim** (unlocalised *Pantling* specimen). In dark, damp gullies, at edge of forests; 330–1200m. Fl. December.

GENERAL DISTRIBUTION. India, Thailand, China, Laos and Vietnam.
ETYMOLOGY. Named after William Roxburgh (1751–1815), a Scottish botanist who worked for the East India Company and was Superintendent of Calcutta Botanic Garden between 1793 and 1813.
NOTES. Lin & Hsu (1976), in a discussion of the differences between *Anoectochilus* and *Odontochilus*, concluded than *A. roxburghii* was the only species with all the features typical of *Anoectochilus*; we therefore retain it there.

Seidenfaden (1992) commented that this species might be conspecific with the Sri Lankan *A. regalis* Bl.

18. **Chamaegastrodia** Makino & F. Maekawa

Plants terrestrial, mycotrophic, leafless. *Stem* with clasping sheaths at intervals, red. *Inflorescence* terminal, racemose, densely flowered. *Flowers* small, non-resupinate. *Sepals* concave, similar, 1-veined. *Petals* similar to sepals. *Lip* 3-lobed, spurless; hypochile saccate; mesochile with epichile T-shaped, lacinate; epichile divaricate, margins erose-lacinate. *Column* short; anther dorsal; rostellum asymmetric; stigma 1; pollinia 2.

The genus *Chamaegastrodia* was established in 1935 by Makino & Maekawa in the *Botanical Magazine (Tokyo)*. The genus comprises about five species distributed in India, Bhutan, SE Asia and Japan.

Chamaegrastrodia was originally described as *Evrardia* in 1932 by Gagnepain, in the *Bulletin du Muséum National d'Histoire Naturelle, Paris*. This name is, however, a homonym of *Evrardia* Adanson (1763) a genus in the Anacardiaceae. Rauschert (1983) therefore proposed the new generic name *Evrardianthe*, while Averyanov (1988a) proposed yet another generic name, *Evrardiana*. Seidenfaden (1994b) reviewed the

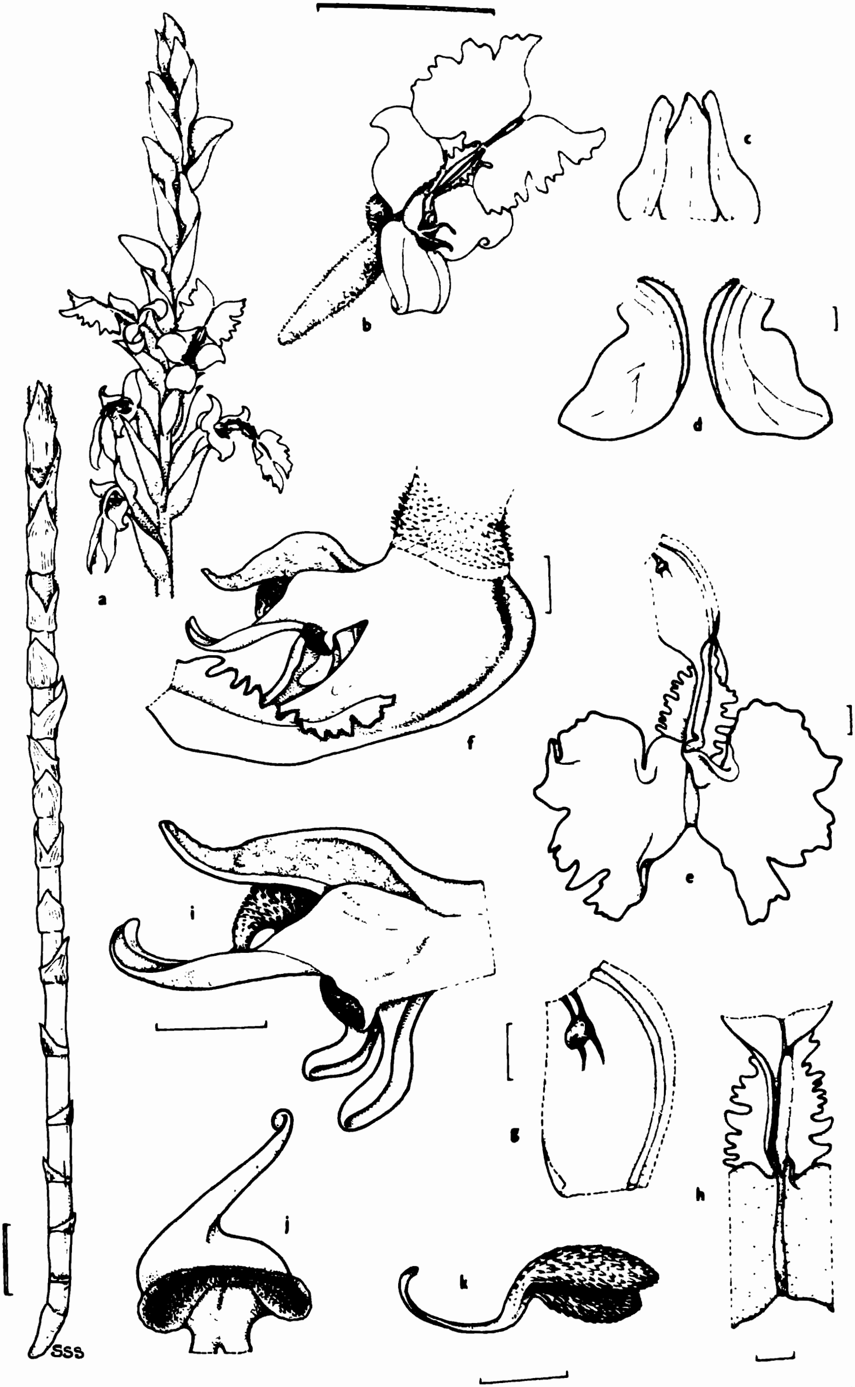


Fig. 19. **Chamaegastrodia asraoa**: a, habit; b, flower; c, dorsal sepal and petals; d, lateral sepals, e, lip (spread); f, lip base and column (side view); g, lip hypochile (detail); h, lip mesochile (detail); i, column (side view); j, column (detail); k, pollinarium. Drawn by Susanna Stuart-Smith from *Broad* s.n. (E).

taxonomy of this genus, and concluded that it was congeneric with *Chamaegrastrodia*, the earliest validly published name.

TYPE. *Chamaegastrodia shikokiana* (Makino) Makino & F. Maekawa; basionym: *Gastrodia shikokiana* Makino, *nom. nud.*
ETYMOLOGY. From the Greek *chamae-* (low-growing) and the related genus *Gastrodia*.

1. C. asraoa (J. Joseph & N.R. Abbareddy) Seidenfaden & A.N. Rao in Nordic J. Bot. 14(3): 299 (1994).
Type: India, Meghalaya, Khasia Hills, *Joseph* 73566 (holo. CAL, iso. ASSAM MH).
Evrardia asraoa J. Joseph & N.R. Abbareddy in Bull. Bot. Surv. India 25(1–4): 232 (1983).

Plant decumbent, c.20cm tall; *roots* clustered, filiform, white, adventitious from nodes. *Stem* c.3mm wide, with many annular sheaths, 0.8–1cm apart; sheaths hyaline, clasping at base, expanding and broadening up the stem. *Inflorescence* densely many-flowered; rachis up to 7cm long; floral bracts elliptic-ovate, concave, edges fringed at base, acute, dorsally keeled, 0.7–1.5 × 0.5–0.6cm (when spread). *Flowers* closed to semi-open, globose, 7–8.5mm across, brick red; pedicel and ovary puberulent, 6–7mm long. *Dorsal sepal* oblong-elliptic, obtuse, dorsally keeled, 4–7.5 × 5mm (when spread); *lateral sepals* joined at the base, concave, elliptic, obtuse, 1-veined, 0.85–1.15 × 0.4–0.5cm (when spread). *Petals* narrowly obpyriform, obtuse, c.5.6 × 2.2mm (at base). *Lip* 3-lobed, joined to base of column, 1.4–1.5 × 1.1–1.2cm; hypochile saccate, with 2 basal calluses; mesochile and epichile folded, complex, deeply erose-dentate with 2 lamellae arising from basal half of mesochile and expanded into a folded ridge that becomes the outer edge of the epichile, apex of mesochile attached to centre of the epichile dorsally; epichile broadly 2-lobed, each lobe subquadrate when spread, deeply erose-lacinate, up to 1cm across both lobes, each lobe 5mm wide when spread. *Column* fleshy, 3–4mm long; anther dorsal; anther cap c.3.6 × 2mm, 2-locular; pollinia 2, mealy; stipe white, S-shaped, c.3mm long; rostellum asymmetric at apex, c.1.5mm long; stigma 1, large, transverse, c.1.5mm across. **Fig. 19.**

Bhutan: C – Tongsa district (Nimjong, 25km ESE of Shemgang). In dense mixed jungle; c.3000m. Fl. August–September.

GENERAL DISTRIBUTION. Nepal, India (Khasia Hills), Thailand, China, Japan and Vietnam.
ETYMOLOGY. Named in honour of Dr A.S. Rao, who has made extensive collections and studied the orchids of the Khasia Hills.
NOTES. This is the first record of this species from Bhutan. It is closely related to, and perhaps synonymous with, *C. poilanei* (Gagnepain) Seidenfaden & A.N. Rao but differs, according to the authors, in 'the absence of elongate terminal lobes for the epichile wings, in the presence of deeply irregular erose mesochile flanges instead of irregular dented, in the presence of simple rostellar processes instead of forked'. Seidenfaden (1994b) revised *Chamaegastrodia* but further collections are required of this interesting, but poorly collected, genus.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

C. shikokiana Makino & F. Maekawa in Bot. Mag. (Tokyo) 49: 596 (1935). Type: Japan, Kawachi, Chihaya, S. *Matsuda* s.n. (lecto. TI, designated by Maekawa in Bot. Mag. (Tokyo) 49: 597 (1935)).
Gastrodia shikokiana Makino in Bot. Mag. (Tokyo) 6: 48 (1892), *nom. nud.*

NOTE. Reported by Rao (1995b) from Munna Camp in the W Kameng district of Arunachal Pradesh.

19. Cheirostylis Bl.

Plants small, terrestrial; *rhizome* decumbent, *roots* nodal, often reduced to ridges or lumps on rhizome. *Leaves* soft, few, petiolate. *Inflorescence* terminal, loosely few-flowered, racemose. *Flowers* small, resupinate. *Sepals* slender, connate halfway to form a sepaline tube with the petals. *Lip* erect, channelled, 2-callose at base; hypochile sac-shaped with several papillose glands along the lateral veins; mesochile short, narrow; epichile 2-lobed, rarely subsigmoid and entire. Column short with 2 stylidia at apex, stylidia commonly as long as the prominent, bifid rostellum; stigmas 2, lateral; pollinia 2, on a short stipe.

The genus *Cheirostylis* was established in 1825 by Carl Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 25 species distributed from SE Africa, SE Asia, Japan, the Philippines to New Guinea.

Brieger (1974) included the genus in his series *Diplostigmata*; it is unusual in that the rhizome is thick and fleshy and the roots are mere bumps of ridges on the rhizome. The apex of the lip is usually 2-lobed, but occasionally it is entire. Hayata (1914) suggested that these latter may represent peloric forms which he placed in a distinct genus, *Arisanorchis*.

TYPE. *Cheirostylis montana* Bl.
ETYMOLOGY. From the Greek *cheiro-* (hand) and *stylis* (a pillar) in reference to the hand-like 'pillars' on the column.

Key to species

1. Leaves more than 5cm long; inflorescence more than 6-flowered .... **3. C. sherriffii**
+ Leaves less than 5cm long; inflorescence fewer than 6-flowered 2

2. Stem base terete, not moniliform; 1- or 2-flowered .... **1. C. griffithii**
+ Stem base moniliform; 3- to 5-flowered 3

3. Flowers and stem glabrous .... **2. C. moniliformis**
+ Flowers and stem pubescent .... **4. C. yunnanensis**

1. C. griffithii Lindl. in J. Proc. Linn. Soc., Bot. 1: 188 (1857). Types: India, Khasia Hills, *Lobb* s.n.(syn. K-LINDL!); Khasia, Mamloo, *Griffith* s.n. (syn. K-LINDL!).
Cheirostylis macrantha Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 2: 83 (1906). Type from Thailand.

Plant 10–18cm tall. *Stem* decumbent below, glabrous, bearing scarious sheaths. *Leaves* withering at flowering, ovate, subacute, base cuneate, 1.8–2.5 × 1.2–1.5cm; petiole short, widened below into a wide hyaline sheath, 0.4–11cm long. *Inflorescence* 1- or 2-flowered at apex, 1–2cm long; peduncle slender, pubescent, bearing several loose, acuminate, scarious sheaths, c.1.2cm long; floral bracts lanceolate, acuminate, shorter than the ovary, 0.5–1 × 0.15–0.2cm. *Flowers* 1–1.8cm long, uniformly white; pedicel and ovary pubescent, 4–8mm long. *Sepals* connate to the middle into a tube, pubescent towards the base, free point acute, spreading, 1–2cm long. *Petals* linear-oblong, falcate, acute, shorter than the sepals, c.1cm long. *Lip* with an elongate, concave base, slightly saccate below its attachment to the column, 1.1–2cm long; sac with 2 parallel rows of short, glandular setae within; apex orbicular, margins fimbriate, epichile broad, deeply fimbriate, c.5mm wide (when spread). *Column* elongate, with 2 linear processes, equalling the spathulate arms of the rostellum. *Fruit* 1.3 × 0.5cm.

Darjeeling (Jaldacca River, King & Pantling (1898)); **Sikkim** (unlocalised *Clarke* specimen). 1200–1450m. Fl. December.

GENERAL DISTRIBUTION. NE India, China and Thailand.
ETYMOLOGY. Named after William Griffith (1810–1845), who collected one of the type specimens in the Khasia Hills.
NOTE. Hara (1971) reported *C. griffithii* from Bhutan but his specimens are referrable to *C. moniliformis*.

2. C. moniliformis (Griff.) Seidenfaden in Dansk Bot. Ark. 32(2): 69 (1978). Type: Bhutan, 'Koree nuddi' (Kuru Chu), *Griffith* 679 (holo. K!, iso. OXF!).

Goodyera moniliformis Griff., Itin. Pl. Khasyah Mts.: 143, no.679 (1848).

Zeuxine moniliformis (Griff.) Griff., Not. Pl. Asiat. 3: 397 (1851); Ic. Pl. Asiat. 3: t.350 (1851).

Cheirostylis bhotanensis T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 86 (1951). Type: Bhutan, *Griffith* 679 (holo. K!).

C. flabellata sensu Lindl. in J. Proc. Linn. Soc., Bot. 1: 187 (1857), non Wight.

Plant slender, up to 12cm tall; rhizome creeping, rooting at the nodes. *Leaves* 3–4, basal, ovate, acuminate, glabrous, 0.6–1.1 × 0.4–0.8cm; petiole short, widened below into a sheathing base, c.4mm long. *Inflorescence* 4- or 5-flowered; peduncle villose, with 3 sheathing bracts inserted about 4cm apart; bracts lanceolate-spathulate, acuminate, c.5mm long; floral bracts elliptic, long-acuminate, glabrous, concave, 5–6 × 1–1.5mm. *Flowers* up to 5mm long, uniformly white; pedicel and ovary cylindric, glabrous, 3- 4.5mm long. *Sepals* lanceolate, glabrous, 1-veined, 3.5–5mm long; *lateral sepals* oblique. *Petals* oblique-oblong, obtuse, 1-veined, connate to margin of the dorsal sepal, 3–4mm. Lip clawed, c.5.5 × 4mm wide; base concave, with 2–3 swellings on the lateral veins; apex 2-lobed, reniform, margins lacinate. *Column* 1–1.5mm long.

Bhutan: C – Punakha (Bhotokha, Lobesa, Yuwak to Wangdi Phodrang), Tongsa (Mangde Chu, Shemgang Dzong) and Mongar (Kuru Chu) districts; **Sikkim** (Saramsa). In forest clearings, shady rocky places in moss; 600–1300m. Fl. March–May.

GENERAL DISTRIBUTION. E Himalaya.

ETYMOLOGY. From the Latin *moniliformis* (like a string of beads).

NOTES. Lindley (1857) believed that *C. flabellata* Wight was synonymous with *Goodyera moniliformis* Griff., citing a plant collected in Bhutan (*Griffith* 679). Seidenfaden (1978a) reviewed this situation and concluded that *C. flabellata* Wight was distinct and referred the Himalayan plants to *C. moniliformis*.

3. C. sherriffii N. Pearce & P.J. Cribb in Edinb. J. Bot. 56(2): 275 (1999). Type: Bhutan, Chungsing, 20 m. N of Hatisar (Gaylegphug), *Ludlow, Sherriff & Hicks* 18539 (holo. BM!).

Plant 15–20cm tall; rooting from nodes; *roots* fleshy, thick, pubescent. *Stem* 8–9cm tall, covered in sheathing leaf bases. *Leaves* 4–5, oblong-lanceolate, acute to acuminate, veined and reticulate, petiolate; petiole sheathing at base, 5–12 × 2.5–4.5cm; sheath hyaline, c.8mm across; petiole 2–4cm long. *Inflorescence* 6- to 10-flowered; peduncle c.4.5cm long, pubescent, with 2 sheathing, lanceolate, apiculate bracts of c.2 × 0.5cm; rachis c.6.5cm long, pubescent; floral bracts elongate-lanceolate, apiculate, hyaline, longer than the flowers, glabrous, c.2 × 0.4cm. *Flowers* c.1 × 0.5cm, glabrous; sepals and petals pale green, lip white; ovary sessile, twisted, pubescent, c.7 × 3mm. *Dorsal sepal* elliptic, obtuse, sparsely pubescent on dorsal surface, boat-shaped, 3-veined, forming a hood with the petals over the column, joined at base to the petals, c.9 × 6mm (when spread); *lateral sepals* joined at base, lanceolate, acute, 3-veined, dorsally pubescent, c.1 × 0.4cm. *Petals* joined at base to dorsal sepal, ovate, obtuse, c.9 × 3.5mm. *Lip* 3-lobed, c.1 × 0.8cm (at the epichile); hypochile bowl-shaped, with a central lamella and two raised, stalked, sea-anemone-like calluses arising from the lateral veins, margins infolded towards the mesochile, c.5 × 4mm (when spread); mesochile short, constricted; epichile broadly 2-lobed, lobes quadrate, finely papillose, margins wavy-dentate. *Column* with 2 fleshy, warty wings at base, c.4mm long; rostellum bifid, c.4mm long; stigmas 2, lateral; anther dorsal; pollinia 2, deeply divided, granular. **Fig. 20.**

Bhutan: S – Gaylegphug district (Chungsing, 20 m. N of Gaylegphug); C – Punakha district (Punakha). In humid evergreen lower montane forest; 1200–1700m. Fl. February–March.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. Named after George Sherriff (1898–1967) who, with Frank Ludlow and J.H. Hicks, collected the type specimen.

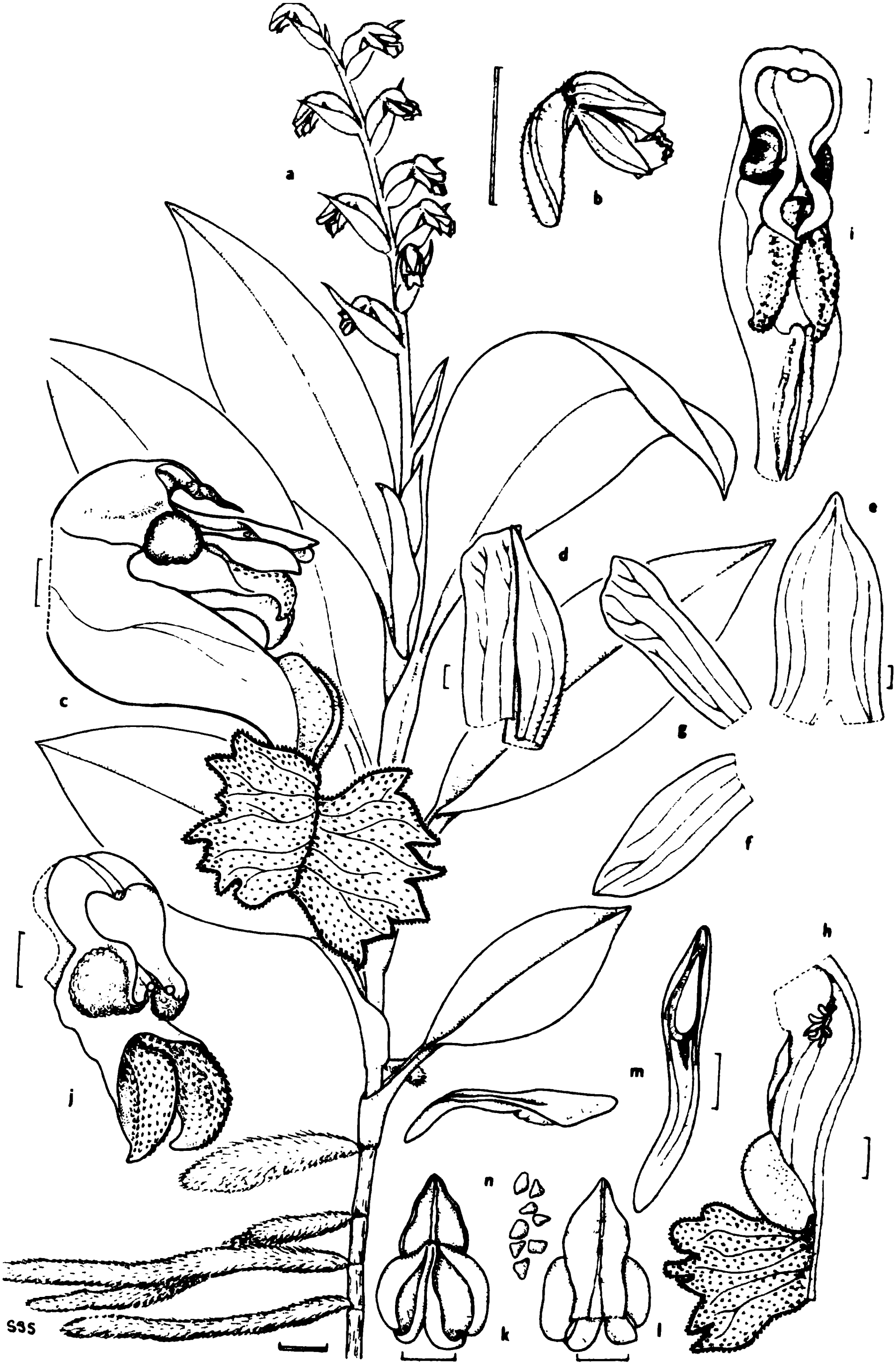


Fig. 20. **Cheirostylis sherriffii**: a, habit; b, flower and ovary; c, column and lip (side view); d, dorsal sepal and petals; e, dorsal sepal; f, lateral sepal; g, petal; h, lip (longitudinal section); i, column and lip base (front view); j, column; k, anther (front view); l, anther (back view); m, pollinarium (two views); n, massulae. Drawn by Susanna Stuart-Smith from *Ludlow et al.* 18539 (BM).

NOTES. *C. sherriffii* is superficially similar to the Taiwanese *Zeuxine odorata* Fukuyama but is a smaller plant, the leaves being oblong-lanceolate rather than obliquely elliptic, the inflorescence shortly pedunculate, the floral bracts and dorsal sepal longer and the calluses not retrorse. It also resembles two other Taiwanese orchids *C. tabiyahanensis* (Hayata) N. Pearce & P.J. Cribb (syn. *C. nemorosa* Fukuyama), but it differs in having much longer floral bracts, a papillose lip apex, 2 sea-amenone-like calluses rather than bristle-like appendages on the hypochile of the lip and a distinct column. In addition *C. nemorosa* is said to be epiphytic.

4. **C. yunnanensis** Rolfe in Bull. Misc. Inform. Kew 1896: 201 (1896). Type: China, Yunnan, Mengtse, *Hancock* 25 (holo. K!).
Cheirostylis pabongensis S.Z. Lucksom in Indian J. Forest. 20(3): 305 (1997). Type: India, Sikkim, *Lucksom* 210 (holo. CAL!, iso. Herb. Forest Dept., Gangtok).

Plant 10–17cm tall. *Pseudobulbs* moniliform, prostrate, pale green, rooting along internodes, 2.5–3 × 0.9–1.4cm. *Leaves* 2–5, ovate, acute to shortly acuminate, 5-veined, petiolate, 1–3 × 0.35–1.5cm; petiole subtubular, 5–7mm long. *Inflorescence* 2- to 4-flowered; peduncle terete, puberulous, sheathed, 9.7–13.2cm long; peduncle sheaths 2 or 3, subtubular, acuminate, puberulous, 0.8–1.4cm long; rachis puberulous, 3–8mm long; floral bracts ovate-lanceolate, acuminate, puberulous, 4–8mm long. *Flowers* 1.1–1.5cm long; sepals green, tinged with pink at tips, lip white with 2 prominent green spots at base; pedicel and ovary shortly stalked, pubescent, c.8mm long. *Sepals* subsimilar, puberulous, united at base to form a sepaline tube, 7–9 × 3.5mm; *dorsal sepal* elliptic, acute, c.9 × 4mm long; *lateral sepals* elliptic, obtuse, 7.5 × 2–2.2mm. *Petals* obovate-oblong to oblong-spathulate, falcate, obtuse, glabrous, 6.5–7.5 × 2mm. *Lip* 1.1–1.4 × 1.2cm (when spread); hypochile saccate, oblong, glabrous; epichile semi-circular, deeply 2-lobed, margins dentate; callus in sac with 2 rows of 3–5 setae. *Column* 2.5mm long; stylidia erect, longer than rostellar arms; anther cap ovate, acute, 1.5 × 0.5mm; pollinia c.1.5mm long.

Sikkim (Pabong). On leaf litter of forest floor; 600–900m. Fl. March–April.

GENERAL DISTRIBUTION. China, Thailand and Vietnam.
ETYMOLOGY. From Yunnan, a province of China, where the type specimen was found.
NOTES. *C. pabongensis* was described by Lucksom in 1997. We have seen the type material and compared it with the closely related *C. yunnanensis* and *C. munnacampensis* (see below) and consider it to be indistinguishable from the former.

Imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

C. munnacampensis A.N. Rao in Nordic J. Bot. 8(4): 340 (1988). Type: India, Arunachal Pradesh, W Kameng district, Tipi, A.N. *Rao* 14567 (holo. Orchid Herbarium Tipi).

NOTE. We have seen no material of this species. It is clearly very closely related to, and possibly conspecific with, *C. yunnanensis* Rolfe from which it differs in having oblong, pubescent petals, a hypochile with 2 rows of 7 villi and stylidia twice as long as the rostellar arms.

C. sessanica A.N. Rao in Nordic J. Bot. 8(4): 339 (1988). Type: India, Arunachal Pradesh, W Kameng district, Sessa, A.N *Rao* 24016 (holo. Orchid Herbarium Tipi).

NOTE. We have seen no material of this species. It is related to *C. pubescens* Parish & Rchb. f. from which it differs in having distantly placed, smaller leaves, a hypochile with 2 bifurcated villi within, and terete, acute stylidia.

C. tippica A.N. Rao in Arunachal Forest News 9(2): 17–20 (1991).

NOTE. We have seen neither the protologue nor any material of this species which Chowdhery (1998) reported from the W Kameng district of Arunachal Pradesh. The hypochile has 4 villi (2 in each half) and 10 leaves.

20. Erythrodes Bl.

Plants terrestrial. *Stem* creeping, erect at intervals, leafy. *Leaves* oblong-ovate, asymmetric, petiolate, broadened at base to envelop the stem. *Inflorescence* terminal, laxly racemose; peduncle pubescent, equalling or exceeding the rachis. *Flowers* resupinate, small. *Lateral sepals* spreading, pubescent; dorsal sepal joined to the petals and forming a hood over the column. *Lip* lying alongside the column; base with a 2-lobed spur, not hidden by the sepals; apex a small, more or less entire lamina. *Column* short, apex setaceous, acuminate; stigma 1; pollinia 2.

The genus *Erythrodes* was described in 1825 by Carl Blume in in his *Bijdragen tot de Flora van Nederlandsch Indië*. Schlechter considered that Blume's Asiatic genus should be considered separate from the American plants for which he used the name *Physurus* L.C. Richard but there is now general agreement that the two genera should be treated as synonymous using the name *Erythrodes*. The genus comprises about 100 species distributed in the Americas and SE Asia.

TYPE. *Erythrodes latifolia* Bl.
ETYMOLOGY. From the Greek *erythraeus* (red) and *-odes* (appearance) in reference to the flower colour of the type species.

1. **E. hirsuta** (Griff.) Ormerod in Seidenfaden, Contr. Orch. Fl. Thail. XIII: 12 (1997). Type: India, Assam, *Griffith* (holo. not found).
Goodyera hirsuta Griff., Not. Pl. Asiat. 3: 393 (1851); Icon. Pl. Asiat. 3: t.347 (1851).
Physurus hirsutus (Griff.) Lindl. in J. Proc. Linn. Soc., Bot. 1: 180 (1857).
P. herpysmoides King & Pantling in J. Asiat. Soc. Bengal 65(2): 124 (1896).
Erythrodes herpysmoides (King & Pantling) Schltr. in Bot. Jahrb. Syst. 45: 392 (1911). Type: 'British Bhutan' (Darjeeling), Engo, *Pantling* 255 (holo. CAL, iso. K!).
E. blumei sensu Gagnepain, Fl. Gen. Indo. China 6: 567, f.53: 17–20, f.54: 1–2 (1934), non (Lindl.) Schltr.
E. latifolia sensu Seidenfaden, Contr. Orch. Fl. Thail. XIII: 12 (1997), non Blume (1825).
E. seshagiriana A.N. Rao in Indian Forester : 643 (1997). Type: NE India, Arunachal Pradesh, Motigeel, *A.N. Rao* 28269 (holo. CAL).

Plant 20–25cm tall. *Stem* 5mm wide at base; lower part leafy, glabrous; upper part pubescent, sheathed; sheaths lanceolate, acuminate, appressed, 2–2.5cm long. *Leaves* 3–4, obliquely ovate, acute, tapering below to a channelled, sheathing petiole, 5- to 7-veined, 6–10 × 3–4.5cm; petiole 2.5–3.5cm long. *Inflorescence* terminal, racemose, subdensely 5- to 15-flowered; rachis glandular-pubescent, 4–7cm long; floral bracts lanceolate, finely acuminate, slightly longer than the ovary, finely pubescent externally, 1–1.5 × 0.15–0.3cm. *Flowers* up to 2cm long; sepals and petals pale reddish-brown, lip white; pedicel and ovary finely glandular-pubescent, 1.2–1.5cm long. *Sepals* similar, oblong-lanceolate, 3-veined, sparsely pubescent, spreading, 6–8 × 1.8–2.1mm. *Petals* linear-spathulate, dilated towards coherent apices, 1-veined, 5–6.5 × 1.6–1.7mm (across the apex). *Lip* appressed to the column, oblong, 5-veined; apex small, transversely oblong, entire, deflexed, 6–6.5mm long; lateral lobes erect, subtruncate; spur shorter than the ovary, wide, slightly inflated below and bifid at the apex, 3–4.5mm long. *Column* 2.8–3.2mm tall; anther lanceolate; clinandrium deep, extending to base of the column; pollinia clavate, c.3mm long. **Fig. 21.**

Darjeeling (above Engo). 1000–1500m. Fl. March–April.

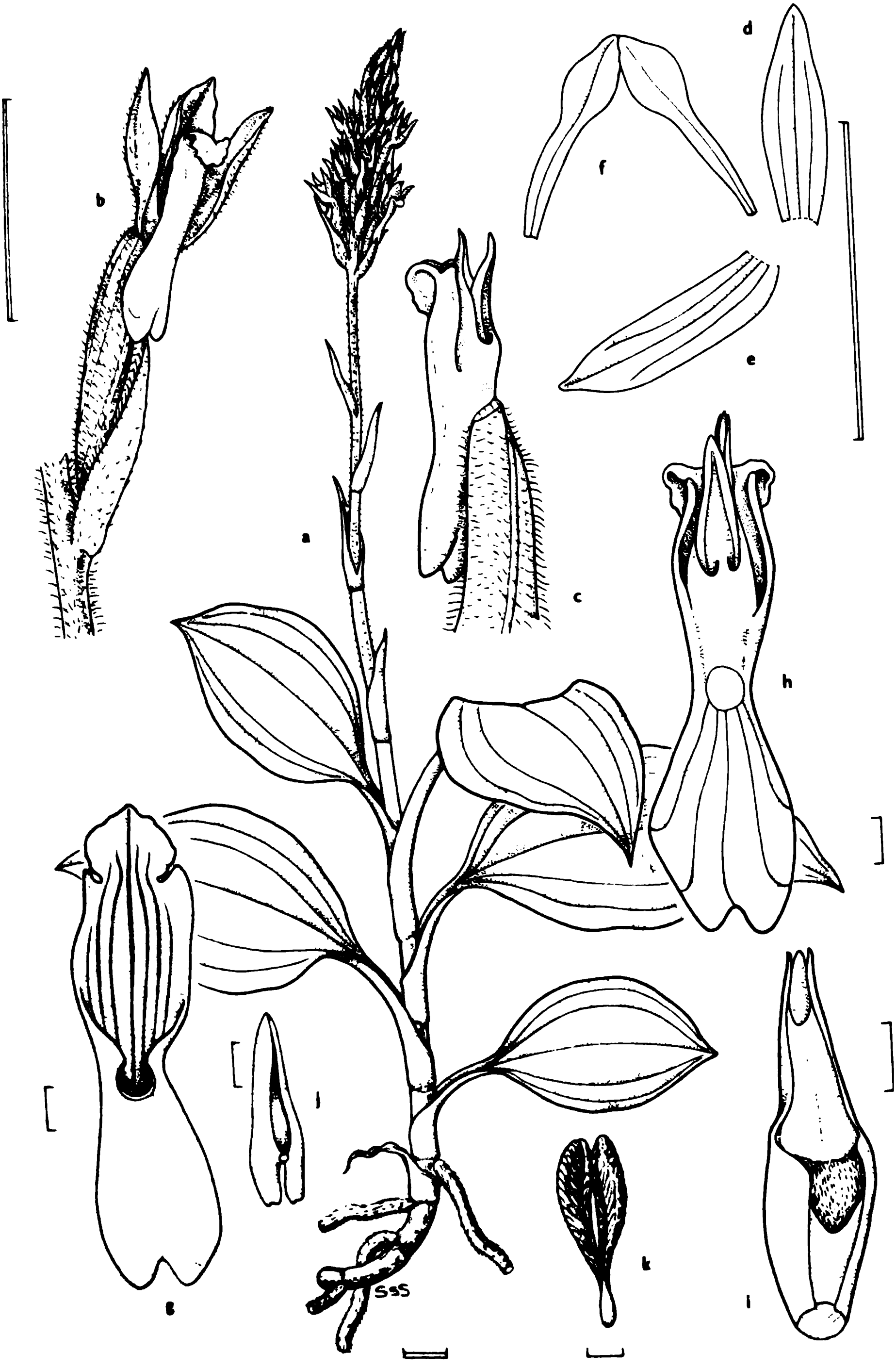


Fig. 21. **Erythrodes hirsuta**: a, habit; b, flower and ovary; c, lip, column and ovary (side view); d, dorsal sepal; e, lateral sepal; f, petals, g, lip and spur; h, lip and column (from behind); i, column; j, anther; k, pollinarium. Drawn by Susanna Stuart-Smith, a from *Pantling* 255 (K); b–j from *Parkinson* 5762 (K); k from icon. in King & Pantling (1898).

GENERAL DISTRIBUTION. E Himalaya, Myanmar, China (Hainan), Thailand and Vietnam.
ETYMOLOGY. From the Latin *hirsutus* (hairy) referring to the ovary and sepals.
NOTES. In 1851 Griffith described a plant collected on the Assam-Burma frontier as *Goodyera hirsuta*. Lindley transferred the plant to *Physurus* but commented that he had seen no specimens and that the type had been lost. Seidenfaden (1978a) was undecided about this species but Ormerod (in Seidenfaden, 1997) proposed that a new combination *E. hirsuta* be created and that *E. herpysmoides* should be reduced to synonymy within this taxon.

21. Goodyera R. Br.

Plants terrestrial or occasionally epiphytic, small to medium; *rhizome* creeping, rooting at nodes. *Stems* erect, leafy. *Leaves* basal or clustered, fleshy, several, usually petiolate from inflated sheaths, sometimes reticulately patterned. *Inflorescence* terminal, erect, few- to many-flowered, racemose; peduncle and rachis often pubescent. *Flowers* small, often secund and pubescent or glandular on outer surface. *Sepals* parallel to the floral axis or with lateral sepals spreading; dorsal sepal forming a hood with petals. *Lip* unlobed, hollow or saccate at base, often setose within, narrowed to an acute apex which is often recurved. *Column* short; rostellum long, deeply cleft; stigma undivided, large; pollinia 2, often deeply cleft, granulose, pyriform or clavate; viscidium elongate.

The genus *Goodyera* was established in 1813 by Robert Brown in the second edition of William Aiton's *Hortus Kewensis*. The genus comprises about 40 species widely distributed in the northern temperate zone, south to Mexico and east to Madagascar, SE Asia, the Pacific Islands, New Guinea and Australia.

In 1858 Blume proposed a sectional treatment for some species. Later, Schlechter (1911) recognised two sections: *Otosepalum* in which the lateral sepals are spreading or deflexed and diverge well away from each other, and *Goodyera* in which the lateral sepals are porrect and parallel to each other. Seidenfaden (1978a) revised the Thai species and a fuller synonymy of the widespread species may be found there.

Bumble-bee pollination has been reported by Kallunki (1976) who observed species of *Bombus* visiting the American *G. oblongifolia* Rafinesque, *G. repens* var. *ophioides* (Fernald) P.M. Brown and *G. tessellata* Loddiges. The fruit set is high and some species may be parthenocarpic or self-fertilising.

LECTOTYPE. *Goodyera repens* (L.) R. Br.; basionym: *Satyrium repens* L.
ETYMOLOGY. Named in honour of John Goodyer (1592–1664), an English botanist.

Key to species

1. Lateral sepals spreading 2
+ Lateral sepals not spreading 4

2. Plant less than 30cm tall; leaves less than 10cm long; few-flowered .... **3. G. viridiflora**
+ Plant more than 30cm tall; leaves more than 10cm long; many-flowered 3

3. Rachis less than 12cm long; floral bracts more than 8mm long; column with a central clavate lobe; flowers brownish-red .... **1. G. clavata**
+ Rachis more than 12cm long; floral bracts less than 8mm long; column lacking a central clavate lobe; flowers greenish-white .... **2. G. fumata**

4. Inflorescence dense, usually much greater than 10cm long; sepals glabrous on outside; leaves more than 9cm long .... **10. G. procera**
+ Inflorescence not dense, usually less than 10cm long; sepals hairy on outside; leaves less than 9cm long 5

5. Inflorescence recurved 6
+ Inflorescence not recurved 7

6. Leaves with large alveolate depressions, orbicular-ovate .... **4. G. alveolata**
+ Leaves lacking alveolate depressions, linear-lanceolate .... **11. G. recurva**

7. Leaves clustered at the stem base, ovate to ovate-lanceolate, usually less than 3.5cm long; flowers white 8
+ Leaves distant along stem, lanceolate, usually more than 3.5cm long; flowers white, green or pink 9

8. Plant robust; stem more than 3mm across; inflorescence cylindric, not secund .... **7. G. fusca**
+ Plant slender; stem less than 2mm across; inflorescence secund, spiral .... **12. G. repens**

9. Leaves strongly reticulate 10
+ Leaves not strongly reticulate, green, blotched with white or with a central silver band 11

10. Flowers more than 5mm across; floral bracts more than 1cm long .... **8. G. hemsleyana**
+ Flowers less than 5mm across; floral bracts less than 1cm long .... **9. G. hispida**

11. Petals united at apices; leaves with a median silvery band .... **14. G. vittata**
+ Petals free; leaves green or mottled with white 12

12. Lip bearing 2 thick lamellae .... **5. G. dongchenii**
+ Lip lacking lamellae 13

13. Floral bracts exceeding flowers, more than 1.5cm long; leaves ovate-lanceolate, lacking white blotching .... **6. G. foliosa**
+ Floral bracts not exceeding flowers, less than 1cm long; leaves lanceolate, with white blotching .... **13. G. schlechtendaliana**

Section **Otosepalum** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 47 (1911).

1. G. clavata N. Pearce & P.J. Cribb in Edinb. J. Bot. 58(1): 116 (2001). Type: India, Sikkim, Rumtek, Teesta (Tista) Valley, Pantling 460 (holo. CAL, iso. BM! K!).
Goodyera grandis sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 284, t.379 (1898), non (Bl.) Bl. (1858).

Plant 38–50cm tall. Stem 27–37cm tall, leafy below, sheathed above; sheaths unequal, lanceolate, acuminate, tubular at base, 2.5–3cm long. *Leaves* obliquely elliptic, subacute, 3-veined, petiolate, 7.5–10 × 3.6–5cm; petiole channelled, dilated and tubular at the base, 5–6.2cm long. *Inflorescence* dense; peduncle pubescent, c.6.2cm long; floral bracts lanceolate, exceeding the ovary, glabrous, margins ciliate, c.7.5mm long. *Flowers* up to 1.5cm across, uniformly a dull rusty-red; ovary sessile, pubescent, c.8mm long. *Sepals* unequal, thinly pubescent externally; *dorsal sepal* oblong-elliptic, obtuse, fleshy, boat-shaped, forming a hood with the petals, c.7.5mm long; *lateral sepals* broadly lanceolate, widely spreading, 3-veined, c.8.5 × 3mm. *Petals* spathulate, 1-veined, 5–7.6 × 2mm. *Lip* simple, fleshy, adnate to base of the column, 5–6.4 × 4mm; base subglobosely saccate, setose within; apex small, narrowly ovate, reflexed and appressed to the underside of the sac. *Column* with a pointed tip, with a distinctive clavate callus extending from the stigma to the base of the lip, 5–6mm long; anther dorsal, 3–4mm long; pollinia clavate, c.2mm long; caudicle hooked, c.1.5mm long. **Fig. 22.**

Sikkim (Rumtek, Tista River). 1200m. Fl. August.

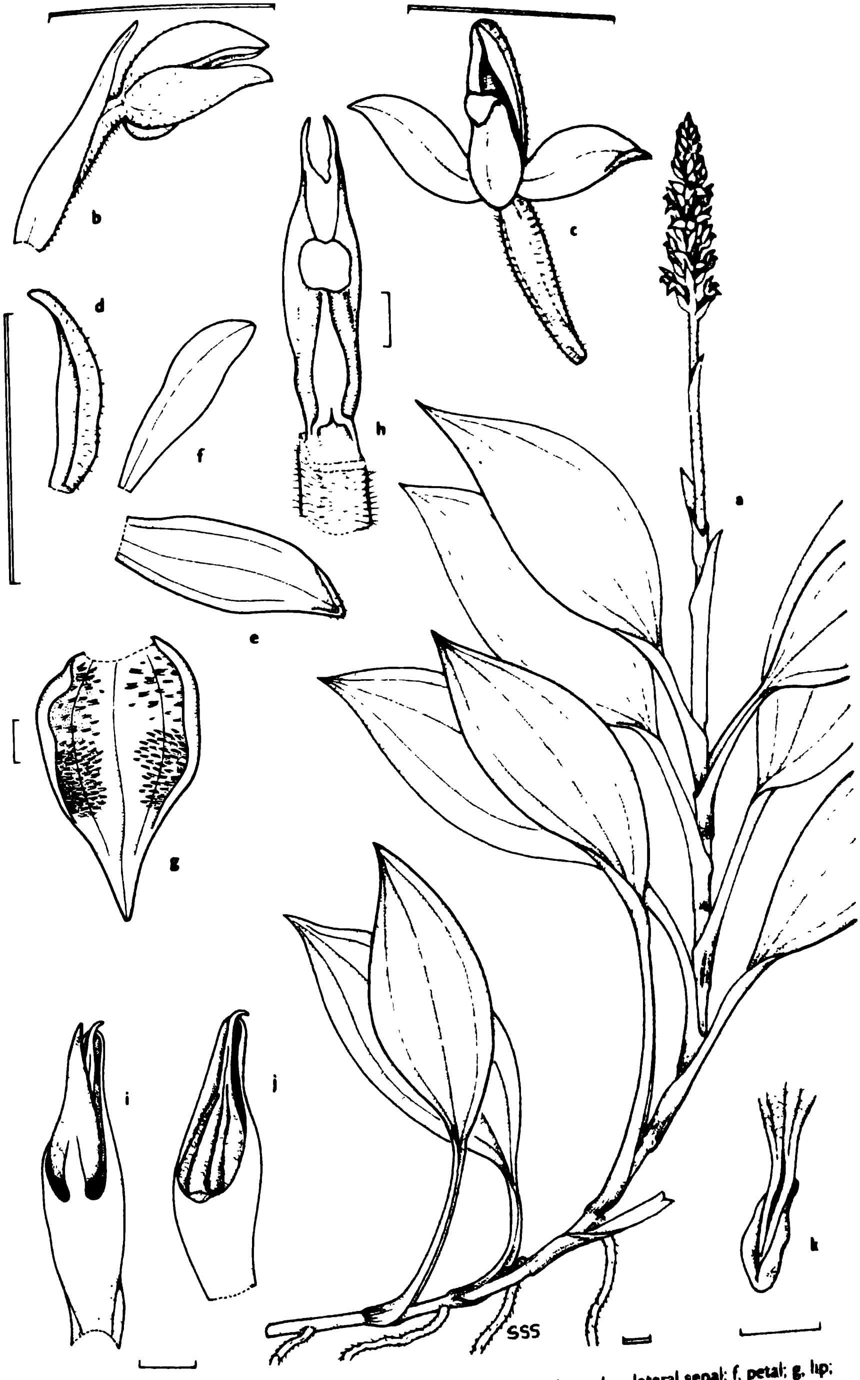


Fig. 22. **Goodyera clavata**: a, habit; b, flower (bud); c, flower; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column; i, column apex; j, column apex (with anther removed); k, pollinarium (base). Drawn by Susanna Stuart-Smith from *Pantling* 460 (K).

GENERAL DISTRIBUTION. E Himalaya.

ETYMOLOGY. From the Latin *clavatus* (club-shaped) in reference to the shape of the callus on the column.

NOTES. King & Pantling (1898) described this species as G. *grandis*, but they had overlooked an earlier use of this name by Blume. King & Pantling stated that the plant they described differed from all other *Goodyera* species by the characteristic clavate callus on the anterior surface of the column below the stigma. We have examined the type specimen (*Pantling* 460) and material of G. *grandis* Bl. from Java and consider that they are different species. The Himalayan plant has a lip without a central claw, the apex is small, reflexed and appressed to the sac which has setose swellings laterally, and the column has the characteristic clavate swelling. The Javan plants have a lip with a central claw, a much longer, recurved apex that is not appressed to the sac which has setose swellings mainly at the junction between the sac and the mesochile, and the column lacks the clavate swelling.

2. **G. fumata** Thwaites, Enum. Pl. Zeyl.: 314 (1864). Type: Sri Lanka (Ceylon), Central Province, *Thwaites* CP 3668 (holo. K!).

Orchiodes fumatum (Thwaites) Kuntze, Revis. Gen. Pl. 2: 657 (1891).

Epipactis fumata (Thwaites) Eaton in Proc. Biol. Soc. Wash. 21: 64 (1908).

Plant up to 1m tall; *rhizome* decurrent, stout; rooting at the nodes. *Stem* ascending, suberect. *Leaves* 3–5, at base of the stem, obliquely elliptic, ovate-elliptic or lanceolate-elliptic, acuminate, petiolate, c.18 × 8cm; petiole c.6cm long. *Inflorescence* cylindric, subdensely to laxly many-flowered; peduncle erect, glabrous below, puberulent above; floral bracts c.1cm long. *Flowers* with spreading segments, tawny to yellowish-green and white; ovary cylindric, sessile, c.1cm long. *Dorsal sepal* oblong-lanceolate, acute, dorsally puberulent, c.7mm long; *lateral sepals* reflexed in the middle. *Petals* linear to axe-shaped. *Lip* conduplicate, boat-shaped, ovate when spread; apex produced into a long, coiled, linear, oblong lobe; disc papillose inside. *Column* stipitate, dilated above; rostellum emarginate, c.5mm long.

Sikkim (Rimbi Chhu). 1800m. Fl. March.

GENERAL DISTRIBUTION. India, Sri Lanka, China, Taiwan, SE Asia, the Malay Archipelago and the Philippines.

ETYMOLOGY. From the Latin *fumeus* (smoky) in reference to the murky floral colour.

3. **G. viridiflora** (Bl.) Lindl. ex Dietrich, Syn. Pl. 5: 165 (1852). Type: Java, Salak, *Blume* s.n. (holo. L not found, iso. P!).

Neottia viridiflora Bl., Bijdr.: 415 (1825).

Georchis cordata Lindl., Gen. Sp. Orchid. Pl.: 496 (1840). Type: Sri Lanka, *Macrae* s.n. (holo. K-LINDL!).

Physurus viridiflora sensu (Bl.) Miquel, Fl. Ind. Bataviae: 734 (1859), non Lindl.

Georchis viridiflora (Bl.) F. Mueller, Fragm. 8: 29 (1873), *nom. superfl.*

Goodyera cordata (Lindl.) Nicholson, Ill. Dict. Gard. 2: 81 (1885).

Orchiodes cordatum (Lindl.) Kuntze, Revis. Gen. Pl. 2: 675 (1891).

O. viridiflorum (Bl.) Kuntze, *loc. cit.* (1891).

Epipactis cordata (Lindl.) Eaton in Proc. Biol. Soc. Wash. 21: 64 (1908).

E. viridiflora (Bl.) Ames, Orchidaceae 2: 61 (1908).

Plant 15–30cm tall; *rhizome* and leaf bearing axis to 4mm in diameter. *Leaves* 4–8, crowded, cordate-ovate, acute to subacuminate, margins often undulate, 2.5–8 × 1–3cm; petiole sheathing at base, 0.5–2cm long. *Inflorescence* 5- to 20-flowered; peduncle usually equal in length to rachis, 3–5cm long; floral bracts lanceolate, acuminate, margins finely pubescent at base, 1.2–1.7 × 0.3–0.4cm long. *Flowers* 1–1.2cm in diameter, uniformly pale green, lip green at base, reddish above and white at apex, column white, greenish-pink below; pedicel and ovary slender, glabrous, 0.6–1cm long. *Dorsal sepal* concave-ovate, glabrous, forming, with the petals, a hood over the column, 0.6–1.2 × 0.25–0.3cm;

lateral sepals subovate, falcate, acuminate, margins involute in distal third, 0.6–1.3 × 0.2–0.4cm. *Petals* clawed, rhombic, dilated in the middle, 0.6–1 × 0.2–0.3cm long. *Lip* simple, broadly ovate, saccate at base, tapering to an acute or acuminate, decurved apex, base densely pubescent, 7–9mm long. *Column* 2–3.5mm long; rostellum narrow, bifid, erect, 0.6–1cm long. *Fruit* ovoid, 1.3–1.5 × 0.6–0.7cm.

Bhutan: C – Punakha district (Jembie?, Tashi Choling, Tashitang). 1900–2200m. Fl. August–November; Fr. April.

GENERAL DISTRIBUTION. India, Nepal, China, Thailand, Malaysia, Indonesia, the Philippines to Samoa.
ETYMOLOGY. From the Latin *viridiflorus* (green-flowered).
NOTES. In the past, plants from the Himalayas have usually been referred to *G. cordata* (Lindl.) Nicholson, a later synonym. Hooker (1890) reported *G. cordata* occurring in the region but only from the Naga Hills and Khasia.

Section **Goodyera**

4. **G. alveolata** Pradhan in Orchid Digest 39(4): 133 (1975), *nom. illegit.*; Indian Orch.; Guide Ident. & Cult. 2: 691 (1979). Type: Bhutan, G.M. *Pradhan* s.n. (holo. Herb. U.C. Pradhan).

Plant up to 20cm tall. *Stem* glabrous, 6–8cm long. *Leaves* 3–5, subequal, petiolate; blade flattened, ovate, acute, glabrous, dorsally pale green tessellated with olive-green, 4.5–7.5cm long; petiole keeled, with wide, flattened, base. *Inflorescence* erect, pubescent, curved, secund, 12- to 15-flowered; rachis 8–10cm long; floral bracts elongate-ovate, boat-shaped, acute to acuminate, 2–2.5cm long. *Flowers* with pinkish-white petals. *Dorsal sepal* 3-veined, dorsally pubescent, united with the petals along the anterior margin, 0.8–1cm long; *lateral sepals* subequal, 3-veined, elliptic, obtuse, c.1 × 0.5–0.8cm wide. *Petals* membranous, c.5mm long. *Lip* elongate, 3-veined, 0.8–1cm long; base saccate; apex reflexed, acute. *Column* short; anther pyriform, dorsally beaked; pollinia 2, clavate.

Bhutan: (without locality). In wet places in forest glades; 2000m. Fl. August–September.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *alveolatus* (pitted, honeycombed), referring to the leaf pattern.
NOTES. Pradhan (1975) described this species based on plants collected from Bhutan. His original publication lacked a Latin description, but he later provided this and validated the name. Pradhan stated that this species was related to *G. recurva* Lindl. (type: *Hooker & Thomson* 345, K-LINDL!) but differed in having orbicular-ovate leaves with large, olive-green depressions rather than linear-lanceolate green leaves. We have not seen the type, nor any other material of this species.

5. **G. dongchenii** S.Z. Lucksom in J. Indian Bot. Soc. 72: 191 (1993). Type: India, Sikkim, Fambong Lho Wildlife Sanctuary, S.Z. *Lucksom* 210 (holo. CAL, iso. Herb. Forest Dept. Gangtok 210).

Plant sometimes epiphytic, 25.5–30cm tall. *Stem* erect, enveloped in subtubular sheaths, 8–10cm tall; sheaths 2.2–3.5cm long. *Leaves* 5–7, oblong-ovate to elliptic-ovate, acute, 5-veined, crowded, 3–7.2 × 1.1–2.5cm. *Inflorescence* erect, many-flowered; peduncle puberulous, 7–8cm long with 3 bracts; bracts lanceolate, subacute, 2.5–4.4cm long; rachis puberulous 11.5–12cm long; floral bracts ovate-lanceolate, acute, 3-veined, puberulous, 0.9–1.9cm long. *Flowers* 7–9mm long, whitish-green, puberulous; pedicel and ovary ribbed, puberulous, 0.7–1.1cm long. *Sepals* subequal, spreading, oblong-ovate, subacute to obtuse, 1-veined, concave; *dorsal sepal* 8.8–9 × 3.5–4mm; *lateral sepals* 8.8–9 × 4–4.2mm. *Petals* falcately oblanceolate, subacute, forming a hood over the column with the dorsal sepal, 8–8.2 × 2.2–2.6mm. *Lip* 7–7.5mm long; base subglobosely saccate, setose within; apex ovate, acute, concave; disc with 2 thick lamellae. *Column* with 2 narrow triangular acute apical processes, c.5.5mm long; anther ovate, long-beaked, c.3mm long; pollinia clavate, orange-yellow.

Sikkim (Fambong Lho Wildlife Sanctuary). On shady forest floor of montane or wet temperate forest, on moss covered trees of *Castanopsis tribuloides* and *Quercus lamellosa*; 1800–2100m. Fl. September–October.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. Not known, but probably geographical.

NOTE. Closely related to *G. foliosa* and differing in having 2 thick lamellae on the disc of the lip and the flowers being whitish-green rather than white suffused with pink.

6. **G. foliosa** (Lindl.) Bentham ex C.B. Clarke in J. Linn. Soc., Bot. 25: 73 (1889). Type: Myanmar (Burma), without precise locality, *Griffith* s.n. (holo. K-LINDL!).

Georchis foliosa Lindl., Gen. Sp. Orchid. Pl.: 496 (1840).

Goodyera secundiflora Griff., Not. Pl. Asiat. 3: 393 (1851); Icon. Pl. Asiat. 3: t.347 f.2 (1851). Type: India, Assam, *Griffith* s.n. (holo. K-LINDL!).

Cystorchis nebularum Hance in J. Bot. 21: 232 (1883). Type: China, Canton, Lo-fan-shan, E. *Faber* 22147 (holo. BM!).

Goodyera bifida sensu Maximowicz in Mélanges Biol. Bull. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 12: 926 (1888), non Bl.

Orchiodes foliosum (Lindl.) Kuntze, Revis. Gen. Pl. 2: 675 (1891).

O. secundiflorum (Griff.) Kuntze, *loc. cit.* (1891).

Goodyera andersonii King & Pantling in J. Asiat. Soc. Bengal 65(2): 127 (1896), **syn. nov.** Type: India, Sikkim, Bakhim, *Anderson* 1228 (holo. CAL n.v.).

G. nebularum (Hance) Rolfe in J. Linn. Soc., Bot. 36: 45 (1903).

Epipactis foliosa (Lindl.) Eaton in Proc. Biol. Soc. Wash. 21: 64 (1908).

Plant up to 30cm tall; *rhizome* long, creeping, stem-like. Stem erect, leafy, 11–20cm tall. *Leaves* obliquely ovate to elliptic-ovate, acute to obtuse, petiolate; blade 2.5–8 × 1–4cm; petiole expanded and sheathing at base, 1–3cm long. *Inflorescence* densely several-flowered; rachis short, 1.5–9cm long; floral bracts linear-lanceolate, acuminate, convex, exceeding the ovary and often exceeding the flower, 1–2cm long. *Flowers* 0.9–1.4cm long, greenish-white suffused with pink-purple; pedicel and ovary 1–1.3cm long. *Dorsal sepal* ovate, hooded, acute, dorsally puberulent, 0.9–1.4cm long; *lateral sepals* oblique, ovate, acute or obtuse, puberulent on the outside, 1–1.4 × 0.4–0.5cm. *Petals* oblique, wedge-shaped to obovate, acute, glabrous, forming a hood with the dorsal sepal over the column, c.9mm long. *Lip* simple, ovate, 0.8–1 × 0.4–0.5cm; base saccate, papillose within; apex obtuse, recurved apex. *Column* short, c.3mm long; rostellum bifid, c.4mm long. *Fruit* 1–1.4 × 0.4–0.5cm.

Bhutan: C –Tashigang district (Rocha Chu, Tashi Yangtsi); N – Upper Kulong Chu district (4km from Tobrang (M.F.B.)); **Darjeeling** (Baghdogra, Labha, Senchal, Tonglu); **Sikkim** (Bakhim, Ramman). On moss in dense jungle, in small bamboo forest; 1500–2700m. Fl. September–November.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, NE India, Myanmar, China, Japan, Taiwan and Vietnam.

ETYMOLOGY. From the Latin *foliatus* (leaf-bearing) in reference to the leafy stem.

NOTES. *G. foliosa* can be distinguished from the closely related *G. schlechtendaliana* by the floral bracts which are longer than the flowers. See also note under *G. schlechtendaliana*.

When describing *G. andersonii* King & Pantling commented that it was allied to *G. cordata* (now included in the synonymy of *G. viridiflora*). However, *G. andersonii* has pubescent sepals, linear petals and was found growing at 2440m. We have not been able to locate the type material, which is probably lost, and can find no records of it since the original description. From the description, however, it appears to be extremely close to *G. foliosa* and we tentatively reduce it to its synonymy here.

7. **G. fusca** (Lindl.) Hook. f., Fl. Brit. India 6(1): 112 (1890). Types: ?India, without precise locality, Wall. Cat. 7395 (syn. K-LINDL!, isosyn. K-W!); Royle s.n. (syn. K-LINDL!).
Aetheria fusca Lindl., Gen. Sp. Orchid. Pl.: 491 (1840).
Cystorchis fusca (Lindl.) Bentham & Hook. f., Gen. Pl. 3: 599 (1883).
Orchiodes fuscum (Lindl.) Kuntze, Revis. Gen. Pl. 2: 675 (1891).

Plant robust, 20–30cm tall. *Stem* glabrous, leaves clustered near the base, with several oblong, acute, leaf-like bracts above; bracts 2–2.5cm long. *Leaves* thick, fleshy, 5-veined, margins revolute, petiolate, 1.8–3.5 × 0.8–2cm; petiole broad, sheathing at base, 1–2cm long. *Inflorescence* compact, pubescent, not secund, densely many-flowered; rachis 5–11.5cm long; floral bracts boat-shaped, ovate-oblong, subacute, exceeding the ovary, 1–1.5cm long. *Flowers* 5–6mm long, white, flushed with green; pedicel and ovary pubescent, 4–6mm long. *Sepals* subequal, oblong, subacute, connivent, 3–7mm long. *Petals* sigmoid, linear-oblong, subacute, 3–5mm long. *Lip* equalling the sepals, 3–5mm long; base saccate, 2-ridged within, conspicuous, projecting beyond base of the lateral sepals; apex abruptly narrowed into a deflexed, linear beak, ridged within. *Column* short, complex, c.1.5mm long; anther convex, 2-lobed, at apex of long-stipitate connective; stigma broad, ovoid; rostellar arms projecting. *Fruit* ovoid, sessile, erect, 5–6 × 3–4mm. **Plate** 4.

Bhutan: C – Tongsa district (Padima Tso, near Thampe La); N – Upper Mo Chu (Gangyuel), Upper Bumthang Chu (Lhanja) and Upper Kulong Chu (Me La) districts; **Sikkim** (Lachung, Thangshing, Yume Samdong). In peaty soil among dwarf rhododendrons, in mossy blanket, on open hillsides, on rocks and cliffs, in *Betula utilis* forest; 3600–5170m. Fl. August–September.

GENERAL DISTRIBUTION. NW India, Nepal, NE India, China (SE Xizang) and N Myanmar.
ETYMOLOGY. From the Latin *fuscus* (a sombre brown) in reference to the brown-scaly scape.

8. **G. hemsleyana** King & Pantling in J. Asiat. Soc. Bengal 64(3): 342 (1896). Type: India, Darjeeling, Senchal, *Pantling* 215A (holo. CAL, iso. BM! K! W!).

Plant 12–25cm tall; *roots* few, thick. *Leaves* 3–5, scattered up stem, unequal, broadly ovate, acute, glabrous, dark green with white reticulations, 2–4.5 × 1–2cm; petiole sheathing at base, 1–1.5cm long. *Inflorescence* 2- to 7-flowered; rachis 2–4cm long; floral bracts laxly glandular-pubescent at base, exceeding the ovary, 1–1.5cm long. *Flowers* subsecund, up to 1.5cm long (including pedicel and ovary), pinkish-white, reddish-brown externally; pedicel and ovary 5–9mm long. *Sepals* subsimilar, 3-veined, 6–9mm long; *dorsal sepal* oblong-lanceolate, upper surface long-pubescent; *lateral sepals* ovate, acuminate. *Petals* 3-veined, oblong-lanceolate, falcate, 6–7mm long. *Lip* oblong, entire, 7–8mm long; base saccate with a sharp tooth at each side of the mouth; apex obtuse, lamellae scabrid. *Column* beaked, 2–3mm long; pollinia elongate-oblong.

Bhutan: C – Punakha district (Nobding); **Darjeeling** (Budhwari, Senchal). In *Quercus lamellosa* forest; 2100–2200m. Fl. July–August(–September).

GENERAL DISTRIBUTIONS. Nepal and NE India.
ETYMOLOGY. Named in honour of W.B. Hemsley (1843–1924), Keeper of the Kew Herbarium from 1899 to 1908.
NOTE. *G. hemsleyana* differs from the related *G. vittata* in its laxly hairy sepals and the scabrid lamellae of the lip.

9. **G. hispida** Lindl. in J. Linn. Soc., Bot. 1: 183 (1857). Type: India, Churra, Khasia Hills, *Hooker & Thomson* 2110 (holo. K!).
Orchiodes hispidum (Lindl.) Kuntze, Revis. Gen. Pl. 2: 675 (1891).

Plant up to 15cm tall. *Leaves* basal, 6–8, subsessile, ovate-lanceolate to elliptic-lanceolate, acuminate, beautifully reticulated with white on green, 2.5–5 × 1.5–2cm. *Inflorescence* erect, spicate, twisted, glandular-hispid, many-flowered; peduncle bearing several short, pubescent, acuminate sheaths, 2–4cm long; rachis 3–6cm long; floral bracts conspicuous, pubescent, lanceolate, acuminate, 0.7–1.1cm long. *Flowers* small, up to 6mm long (with pedicel and ovary); sepals olive-green with white tips, petals and lip dull white; pedicel and ovary pubescent, 4–6mm long. *Sepals* ovate-oblong, obtuse, concave, recurved at apex, minutely pubescent on upper surface, 2–3.5 × 1–1.5mm. *Petals* oblong-lanceolate, nearly straight, subacute, 2–3.5 × 1–1.5mm. *Lip* subglobosely saccate, setose within, shortly, obtusely beaked, apex recurved, 3–5 × 2–3mm. *Column* short, with linear arms; anther pyriform.

Darjeeling (Kala Jhora, Tista River Valley); **Sikkim** (between Yoksam and Bakhim). 300–2200m. Fl. September; Fr. May.

GENERAL DISTRIBUTION. India, Thailand (?extinct—Seidenfaden, 1978a), Vietnam and Malaysia.
ETYMOLOGY. From the Latin *hispidus* (covered with coarse, rigid hairs) in reference to the bristly hairs inside the saccate base of the lip.

10. **G. procera** (Ker Gawler) Hook., Exot. Fl. 1(3): t.39 (1823). Type: Nepal, icon. Wallich 619 (holo. K!).
Neottia procera Ker Gawler in Bot. Reg. 8: t.639 (1822).
Goodyera carnea A. Richard in Ann. Sci. Nat. (Paris) sér.2, 15: 80 (1841). Type: India, Nilgiri Hills, *Perrottet* 1107 (holo. P, iso. K-LINDL!).
Cordylestylis foliosa Falconer in J. Bot. (Hooker) 4: 74 (1842). Types: India, Rajpoor, *Falconer* (holo. not found); Bhutan, *Griffith* (holo. not found).
Leucostachys procera (Ker Gawler) Hoffmannsegg, Verz. Orch. ed.1: 26 (1842).
Orchiodes procerum (Ker Gawler) Kuntze, Revis. Gen. Pl. 2: 675 (1891).
Epipactis procera (Ker Gawler) Eaton in Proc. Biol. Soc. Wash. 21: 65 (1908).
Peramium procerum (Ker Gawler) Makino in J. Jap. Bot. 6: 36 (1929).

Plant up to 1m tall; *rhizome* stem-like, decumbent, rooting at the nodes. *Stem* erect, leafy in the basal third, bearing 3 or 4 sheaths above, 25–50cm tall. *Leaves* linear-lanceolate to ovate-lanceolate, petiolate, acuminate, 11–17 × 3–6cm; petiole sheathing at base, 5–8cm long. *Inflorescence* densely many-flowered; rachis 12–30cm long; floral bracts ovate-lanceolate, acuminate, margins ciliate, 0.5–1cm long. *Flowers* subglobose, 3–4mm across, uniformly white; pedicel and ovary twisted, 3–5mm long. *Sepals* similar, ovate to ovate-elliptic, acute or obtuse, glabrous, 2–3mm long. *Petals* spathulate, acute, forming a hood with the dorsal sepal, 2–3mm long. *Lip* subglobose-saccate, 1.5–2.5mm long; disc covered with pellucid glands; apex recurved, with 2 white tubercles at the base. *Column* fleshy, 1–1.5mm long; rostellum divergent, finely streaked. *Fruit* ovoid, 4–5 × 2–3mm.

Bhutan: S – Samchi (Chepuwa Khola) and Sarbhang (Chirang) districts; C – Punakha district (Wangdi Phodrang); **Darjeeling** (Dalkajhar, Happy Valley, above Labha, Rishep); **Sikkim** (Rangit River, 5km E of Raniphul, Rangpo, Tista River). On damp roadside banks, in dense subtropical forest and hot valleys, in moist, scrubby banks; 300–1900m. Fl. March–May; Fr. June.

GENERAL DISTRIBUTION. India, Sri Lanka, China, SE Asia, Taiwan, Malaysia, Java and the Philippines.
ETYMOLOGY. From the Latin *procerus* (tall) in reference to the size of the plant.
NOTE. G. *procera* is the largest of the species found in our area.

11. **G. recurva** Lindl. in J. Proc. Linn. Soc., Bot. 1: 183 (1857). Type: India, Khasia, *Hooker & Thomson* 345 (holo. K-LINDL!, iso. K!).
Goodyera prainii Hook. f., Fl. Brit. India 6(1): 112 (1890); Icon. Pl. 22, ser.4(2): t.2182 (1894). Type: India, Assam, Puhinabadya, *Prain* 59 (holo. K!).
Orchiodes recurvum (Lindl.) Kuntze, Revis. Gen. Pl. 2: 675 (1891).
Goodyera recurva var. *prainii* (Hook. f.) Pradhan, Indian Orch.: Guide Identif. Cult. 1: 106 (1976).

Plant epiphytic, 10–17cm tall; *rhizome* creeping, rooting along length, branching, 2–3mm thick. *Stem* with sheaths at base, leaves distant along stem, with leaf-like bracts above, pubescent, 8–14.5cm tall; basal sheaths membranous, 0.8–1cm long; bracts linear-lanceolate, acute, 1–2 × 0.15–0.2cm. *Leaves* 7–9, distichous, lanceolate, acute, narrowed at base, reticulate, 2.4–4.5 × 0.6–1.2cm; petiole broad, channelled, 0.6–1.2cm; sheath broad, 1.5–1.8cm long. *Inflorescence* abruptly recurved, secund, densely many-flowered; rachis pubescent, 4.5–6cm long; floral bracts linear-filiform, acute, pubescent, 0.7–1 × 0.05–0.1cm. *Flowers* 3–6mm long, uniformly white; pedicel and ovary pubescent, 5–6mm long. *Dorsal sepal* ovate-lanceolate, abruptly acuminate, pubescent, 4–5 × 1.2–1.6mm; *lateral sepals* similar. *Petals* obliquely linear-lanceolate, acute, 4–5mm long. *Lip* simple, saccate at base, oblong, channelled, 3–4mm long. *Column* 1–2mm tall; rostellar arms long-linear, acuminate; stigma round, central; pollinaria clavate. *Fruit* ovoid, ribbed, shortly stalked, pubescent, 4–6 × 4–5mm.

Bhutan: C – Tashigang district (Dangma Chu). On mossy tree trunks, on *Mahonia napaulensis*; 2000–2300m. Fl. August–September.

GENERAL DISTRIBUTION. NE India (Meghalaya, Arunachal Pradesh) and China.

ETYMOLOGY. From the Latin *recurvus* (recurved) a reference to the characteristic inflorescence.

NOTES. G. *prainii* Hook. f. is closely related to G. *recurva* and Pradhan (1976) reduced it to varietal status under G. *recurva*. Wang (1994) treated it as conspecific with G. *recurva* and, with only the type material to examine, we follow this position.

12. **G. repens** (L.) R. Br. in Aiton, Hortus Kew. ed.2(5): 198 (1813). Lectotype: *Orchis radice repente* in Camerarius, Epit.: t.35 (1588), designated by Baumann *et al.* in Mitt. Bl. Arbeit. Heim. Orch. Baden-Württ. 21: 479 (1989).

Satyrium repens L., Sp. Pl.: 945 (1753).

Epipactis repens (L.) Crantz, Stirp. Aust. Fasc. ed.2: 473 (1769).

Neottia repens (L.) Sw. in Kongl. Vetensk. Akad. Nya. Handl. 21: 226 (1800).

Peramium repens (L.) Salisbury in Trans. Hort. Soc. London 1: 301 (1812).

Goodyera marginata Lindl., Gen. Sp. Orchid. Pl.: 493 (1840). Type: India, Kamaon, coll. R. *Blinkworth* Wall. Cat. 7394A (syn. K-W!); Nepal, *Wallich's collectors* Wall. Cat. 7394B (syn. K-LINDL!, isosyn. K-W!); India, without provenance, *Royle* s.n. (syn. K-LINDL!).

Orchiodes repens (L.) Kuntze, Revis. Gen. Pl. 2: 674 (1891).

Goodyera mairei Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 17: 65 (1921). Type: China, Yunnan, E. *Maire* s.n. (holo. B).

G. *brevis* Schltr. ex Limpricht in Feddes Repert. Spec. Nov. Regni Veg. Beih. 12: 345 (1922). Type: China, Xizang, *Limpricht* 2344 (holo. B).

Epipactis mairei sensu (Schltr.) Hu in Rhodora 27: 106 (1925), non Schltr. (1919).

Goodyera repens var. *marginata* (Lindl.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 68 (1951).

G. *repens* subsp. *marginata* (Lindl.) Kitamura in Acta Phytotax. Geobot. 22: 66 (1966).

Plant slender, up to 20cm tall; *rhizome* creeping, with stolons above the soil. *Stem* erect, glandular-pubescent, leaves crowded near the base, 8–15cm tall; sheathing bracts 2–6, 0.8–2.5cm long. *Leaves* elliptic-ovate to cordate, reticulate, petiolate, 1–3 × 0.8–1.6cm. *Inflorescence* narrowly cylindric, weakly spiral to secund, densely to laxly few- to many-flowered; rachis 2–6.5cm long; floral bracts lanceolate, acute, 0.7–1cm long. *Flowers* pendent, 4–5mm long, uniformly white to cream; pedicel and ovary cylindric, subsessile, glandular-pubescent, 5–8mm long. *Sepals* similar, ovate, dorsally glandular-pubescent, 4–5mm long. *Petals* lanceolate, adherent to the inner margins of the dorsal sepal, c.4mm long. *Lip* undivided, 2.5–4mm long; base hollow, papillose within; apex oblong, flat. *Column* 1–1.5mm long; rostellum bifid. *Fruit* 5–6 × 2–3mm.

Bhutan: S – Chukka district (Sinchu La); C – Thimphu (Dechencholing, above Paro), Thimphu/Punakha (Dochu La), Tongsa (Chale La, Rukubji) and Tashigang (Rocha Chu, Tashi Yangtsi) districts; N – Upper Bumthang Chu (Kopub) and Upper Kulong Chu (Lao) districts; **Sikkim** (Dzongri, Lachung, Pongong); **Chumbi** (Kungphu). On moss, under dense *Abies* forest, in *Quercus/Rhododendron* forest; 2400–3600m. Fl. August–October.

GENERAL DISTRIBUTION. N America, Europe, east to the Himalayas, China and SE Asia.
ETYMOLOGY. From the Latin *repens* (creeping), in reference to the growth habit.
NOTES. In 1840 Lindley described *G. marginata* from Nepal, which differed from *G. repens* in having glabrous sepals. Tuyama (in Ohashi, 1975) examined many plants and found that hairiness was a variable feature in Himalayan plants and was no basis on which to separate this species. We have examined a number of plants, including the type (*Wallich* 7394), and agree with this conclusion.

13. G. schlechtendaliana Rchb. f. in Linnaea 22: 861 (1849). Type: Japan, Göring s.n. (holo. W!).
Georchis schlechtendaliana (Rchb. f.) Rchb. f. in Bonplandia 5: 36 (1854).
Goodyera secundiflora sensu Lindl. in J. Proc. Linn. Soc., Bot. 1: 182 (1857), non Griff.
Orchiodes schlechtendaliana (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 675 (1891).
Epipactis schlechtendaliana (Rchb. f.) Eaton in Proc. Biol. Soc. Wash. 21: 68 (1908).
G. labiata Pampanini in Nuovo Giorn. Bot. Ital. 17: 246 (1910). Type: China, Hupeh, *Silvestre* s.n. (holo. FI).
G arisanensis Hayata, Icon. Pl. Formos. 6: 91 (1919). Type from Taiwan.
Epipactis labiata (Pampanini) Hu in Rhodora 27: 106 (1925).
E. secundiflora (Lindl.) Hu, loc. cit. 106 (1925).

Plant 10–25cm tall. *Stem* enclosed in loosely sheathing petioles, 9–21cm tall. *Leaves* 2–5, clustered towards base, ovate-lanceolate to elliptic-acute, petiolate, green with white mottling or spots, reticulate, 2–4 × 1.5–2.5cm; petiole sheathing at base, 1.5–3cm long. *Inflorescence* many-flowered, densely glandular-pubescent to tomentose; rachis 5–11cm long; floral bracts lanceolate, acute, exceeding the ovary, 0.7–1.1cm long. *Flowers* broadly ovoid, up to 1cm long; sepals yellowish-pink, petals white, lip white tipped with green; pedicel and ovary glandular-pubescent, twisted, 0.5–1cm long. *Dorsal sepal* broadly lanceolate, dorsally pubescent, 0.9–1.1 × 0.25–0.35cm; *lateral sepals* obliquely ovate, pubescent, 1.1–1.2 × 0.35–0.45cm. *Petals* obovate-lanceolate, appressed to the dorsal sepal, 1–1.1 × 0.3–0.35cm. *Lip* long-ovate, 0.9–1.1 × 0.4cm; base spathulate, saccate, pilose within. *Column* curved, 5–6mm long. **Plate 5.**

Bhutan: S – Chukka district (between Bunakha and Chapcha, Chima Kothi, Mathur Bridge); C – Thimphu (Pajoding), Punakha (between Dochu La and Menchunang, Ritang) and Tongsa (Chendebi Chorten, Tashiling) districts; N – Upper Mo Chu (above Tamji) and Upper Kulong Chu (near Tobrang, (M.F.B.)) districts; **Darjeeling** (Labha, Senchal). In *Quercus griffithii* forest, on mossy banks; 1500–2270m. Fl. August–September; Fr. April.

GENERAL DISTRIBUTION. India, Thailand, China, SE Asia, Japan and Sumatra.
ETYMOLOGY. Named after Dieterich Leonhard von Schlechtendal (1794–1866), a German botanist and Editor of *Linnaea* between 1826 and 1866.
NOTE. Seidenfaden (1978a) provided a comprehensive discussion of the nomenclatural complexities of this species and the status of *G. secundiflora* Lindl. *G. secundiflora* Griff. is now treated as a synonym of *G. foliosa*.

14. G. vittata (Lindl.) Bentham ex Hook. f., Fl. Brit. India 6(1): 113 (1890); Icon. Pl. 22: t.2185 (1894). Type: India, Sikkim, *Hooker* 336 (holo. K-LINDL!).
Georchis vittata Lindl. in J. Proc. Linn. Soc., Bot. 1: 184 (1857).
Orchiodes vittatum (Lindl.) Kuntze, Revis. Gen. Pl. 2: 675 (1891).

Plant 10–20cm tall. *Stem* stout, glabrous, enveloped in long, tubular leaf sheaths, 9–11cm tall. *Leaves* thick, ovate-lanceolate, acute, upper surface green with a silver band on the midrib, lower surface suffused with purple, petiolate, 2–5 × 1–2cm; petiole 1–1.5cm long. *Inflorescence* secund, crowded; peduncle glabrous, 2–3.5cm long, bearing several narrowly lanceolate, acuminate, overlapping bracts; rachis 5–7.5cm long; floral bracts lanceolate, acuminate, slightly exceeding the ovary, 0.7–1.2cm long.

Flowers held horizontally, up to 5mm long, uniformly pink-white; pedicel and ovary linear, glabrous, 6–8mm long. Sepals subsimilar, oblong-ovate, acute, 6–8mm long. Petals narrowly oblong-ovate, cohering by their inner margins for half their length, 6–7mm long. Lip exceeding the sepals, saccate at base, 8–9mm long; sac elongate, setose within; apex oblong-lanceolate, subacute, bilamellate. Column stout; acute beaked, acuminate; pollinia clavate; rostellum long, erect.

Bhutan: C – Punakha (Ritang Valley), Mongar (Kuru Chu, Lhuntse), Mongar/Tashigang (Donga La) and Tashigang (Rocha Chu) districts; **N** – Upper Mo Chu district (Gasa); **Sikkim** (Bakhim, Lachen, Prek Chhu, Rathang Chhu, Singalila Range). In rain-forest, bamboo and oak jungle; in hot valleys, in Hemlock/Rhododendron forest; 1500–3000m. Fl. July–September; Fr. April.

GENERAL DISTRIBUTION. Nepal, NE India and China.
ETYMOLOGY. From the *vittatus* (longitudinally striped) in reference to the silver stripe on the leaves.
NOTE. Hooker (1890) stated that G. *vittata* was 'the only perfectly glabrous Indian species of *Goodyera*'.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

G. biflora (Lindl.) Hook. f., Fl. Brit. India 6(1): 114 (1890). Type: ?Nepal, Wall. Cat. 7379 (holo. K-LINDL!, iso. K-W!).
Georchis biflora Lindl., Gen. Sp. Orchid. Pl.: 496 (1840).
Epipactis biflora (Lindl.) Eaton in Proc. Biol. Soc. Wash. 21: 63 (1908).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

G. macrantha Maximowicz in J. Gén. Hort. 7: 113 (1867–68). Type: Japan, Yedo, *Oldham* s.n. (holo. BM).

NOTE. Reported by Rao & Hajra (1976) and Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

22. **Herpysma** Lindl.

Plant terrestrial. *Stem* decumbent and erect. *Leaves* ovate-lanceolate, distant along the stem. *Inflorescence* racemose, subglobose, densely flowered. *Sepals* and *petals* connivent. Lip spurred, base joined to the column, deflexed from the middle; apex suborbicular to subquadrate; disc 2-callose. Column short, semi-terete; pollinia 2; stigma 1.

The monotypic genus *Herpysma* was established in 1833 by John Lindley in the *Botanical Register*. It is widely distributed in S and SE Asia.

TYPE. *Herpysma longicaulis* Lindl.
ETYMOLOGY. From the Greek *erpysmo* (to creep) in reference to the growth habit.

1. **H. longicaulis** Lindl., Gen. Sp. Orchid. Pl.: 506 (1840). Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 7389 (holo. K-LINDL!, iso.K-W! K!).
Physurus bracteata Bl., Coll. Orchid.: 97, t.28 (1858). Type from Sumatra.
Erythrodes bracteata (Bl.) Schltr. in Schumann & Lauterbach, Nachträge Fl. Schutzgeb. Südsee: 89 (1905).
Herpysma sumatrana Carr in J. Malayan Branch Roy. Asiat. Soc. 11(1): 69, t.1b (1933). Type from Sumatra.
H. bracteata (Bl.) J.J. Smith in Blumea 1: 213 (1934).

Plant to 38cm tall. *Stem* 22–38 × 0.4–0.5cm; leaf sheaths pale, truncate, pubescent, membranous, 1.5–2cm long. *Leaves* ovate-lanceolate to narrowly elliptic, tapering at each end, reticulate, 5–9 × 2–3.8cm; petioles sheathing at base, 2.5–4cm long (including sheath). *Inflorescence* pubescent, densely many-flowered; rachis 2–3.5cm long; floral bracts oblong-lanceolate, obtuse, ribbed, exceeding the

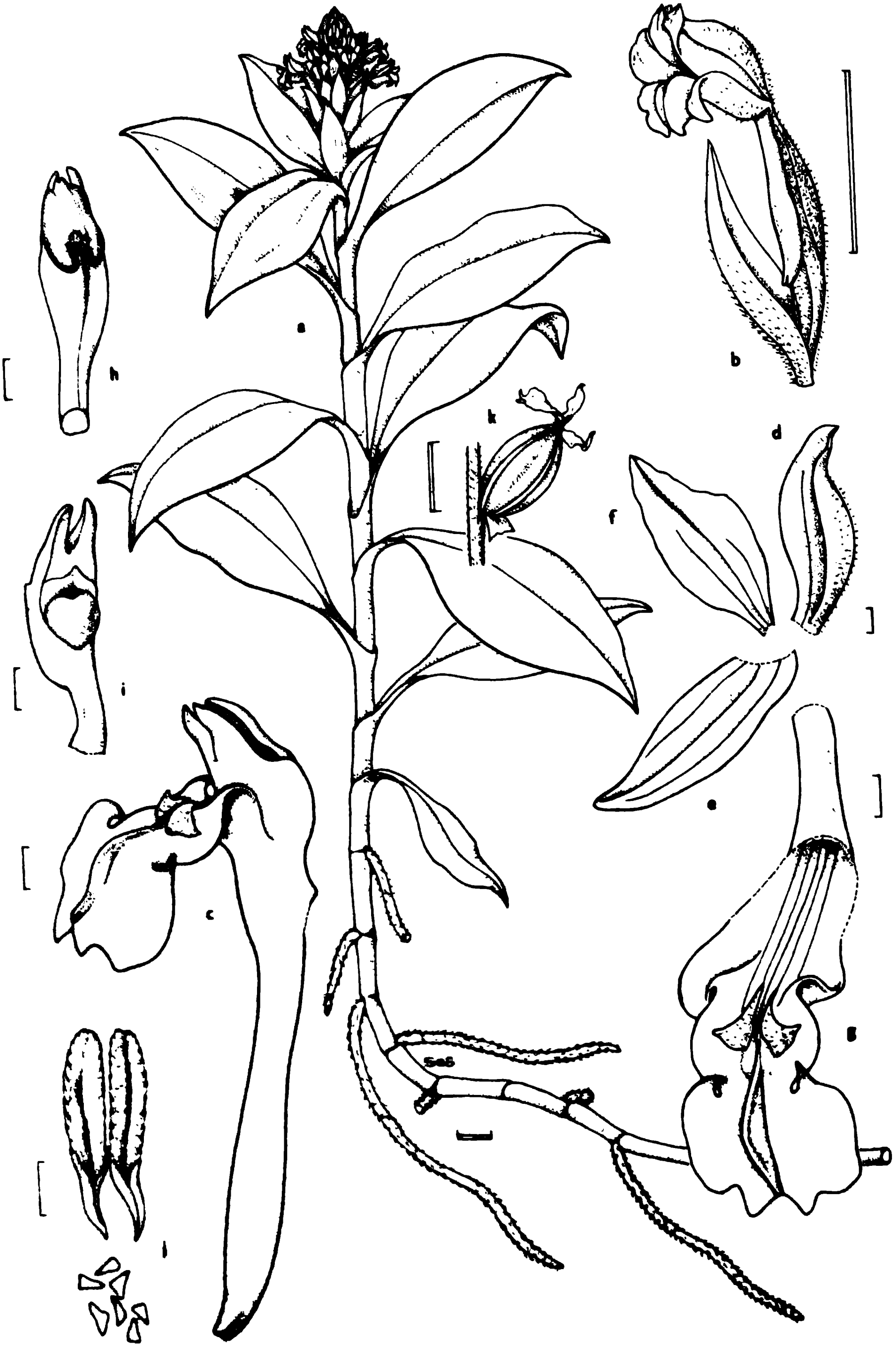


Fig. 23 *Herpysma longicaulis*: a, habit; b, flower, ovary and bract; c, lip, spur and column; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (back view); i, column (front view); j, pollinaria and massulae; k, fruit. Drawn by Susanna Stuart-Smith. a from *Pantling* 240 (K); b–i from *Treutler* 1173 (K); j from icon. in King & Pantling (1898). k from *Hooker* 340 (K)

ovary, pubescent externally, 1–1.8 × 0.3–0.4cm. *Flowers* up to 1cm long, uniformly white, sepals and petals tinged with orange-red to pink; pedicel and ovary sessile, 0.8–1cm long. *Sepals* subsimilar, broadly lanceolate, subacute, pubescent on the dorsal surface, 3-veined, 7–1.1 × 0.25–0.35cm; dorsal sepal boat-shaped. *Petals* clavate, elliptic-lanceolate, acute, 3-veined, 6–9 × 3.8–4mm. *Lip* oblong, deflexed from the middle; base with 2 rounded lobes; apex subquadrate, apiculate, 6–9.3mm long; disc with 2 complanate calluses with a lamella between; spur long, slender, bifid at apex, 8–9mm long. *Column* contracted below the broad convex central stigma, 2–6mm long; pollinia elongate, c.3.3mm long. *Fruit* sessile, 1.6–2 × 0.4–0.8cm. **Fig. 23.**

Bhutan: C – Punakha district (Rimchu, Tashitang); **Darjeeling** (Rishap); **Sikkim** (Rongpa). 900–1700m. Fl. September–November.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China (Yunnan), Thailand, Vietnam and Sumatra.
ETYMOLOGY. From the Latin *longus* (long) and *caulis* (stem).
NOTE. The subglobose inflorescence and the decumbent habit of this species makes it relatively easy to recognise.

23. Hetaeria Bl.

Plant terrestrial; *rhizome* short, decumbent, rooting at nodes. *Stem* ascending to erect, leafy. Leaves fleshy, ± petiolate. *Inflorescence* terminal, spicate, laxly to densely many-flowered. *Flowers* non-resupinate, small. *Sepals* free, connivent or gaping. *Petals* adherent to the dorsal sepal. *Lip* with a ventricose base, convex, callose within; entire or with divaricate apical lobes. *Column* short, with 2 parallel, keeled lamellae in front; anther dorsal, erect with distinct cells; pollinia granulose; rostellum bifid; stigma transverse, 2-lobed.

The genus was first established by Carl Ludwig Blume in 1825 in his *Bijdragen tot der Flora van Nederlandsch Indië* in 1825 as *Etaeria*. In 1828, in his *Flora Javae et Insularum Adjacentium*, Blume altered the spelling to *Hetaeria* and this later spelling has been conserved over the earlier one. Sprague (1929) reviewed the confusion over the two spellings and concluded that the omission of the initial 'H' was due to an unintentional error. The genus comprises about 20 species with a pantropical distribution.

LECTOTYPE. *Hetaeria oblongifolia* (Bl.) Bl.; basionym: *Etaeria oblongifolia* Bl.
ETYMOLOGY. From the Greek *etaeria* (companionship) in reference to the habit which resembles other closely related genera.

Key to species

1. Flowers green, tipped with pink; petals less than 4mm long; column less than 2mm long **1. H. affinis**
+ Flowers white; petals more than 8mm long; column more than 3mm long .... **2. H. pelota**

1. H. affinis (Griff.) Seidenfaden & Ormerod, in Oasis, Suppl. 2:9 (2001). Type: India, Assam, Negrogam, *Griffith* 315 (holo. K, lost).
Goodyera affinis Griff., Not. Pl. Asiat. 3: 391 (1851); Icon. Pl. Asiat. 3: t.351.B, f.7 (1851).
Cerochilus rubens Lindl. in Gard. Chron. ser.1, 1854: 87 (1854). Type: Country of origin unknown, cult. Hanbury (holo. K-LINDL!).
Rhamphidia rubens (Lindl.) Lindl. in J. Proc. Linn. Soc., Bot. 1: 182 (1857).
Hetaeria rubens (Lindl.) Bentham ex Hook. f., Fl. Brit. India 6(1): 115 (1890).

Plant 25–35cm tall. *Stem* leafy, glabrous. *Leaves* ovate-elliptic, more or less oblique to subacute, 5-veined, 7.5–11.5 × 4.5–5cm; petiole sheathing at base, 2–2.5cm long. *Inflorescence* densely many-flowered; peduncle puberulent, bearing 3–5, distant, clasping, lanceolate, acuminate sheaths, 1–1.3cm

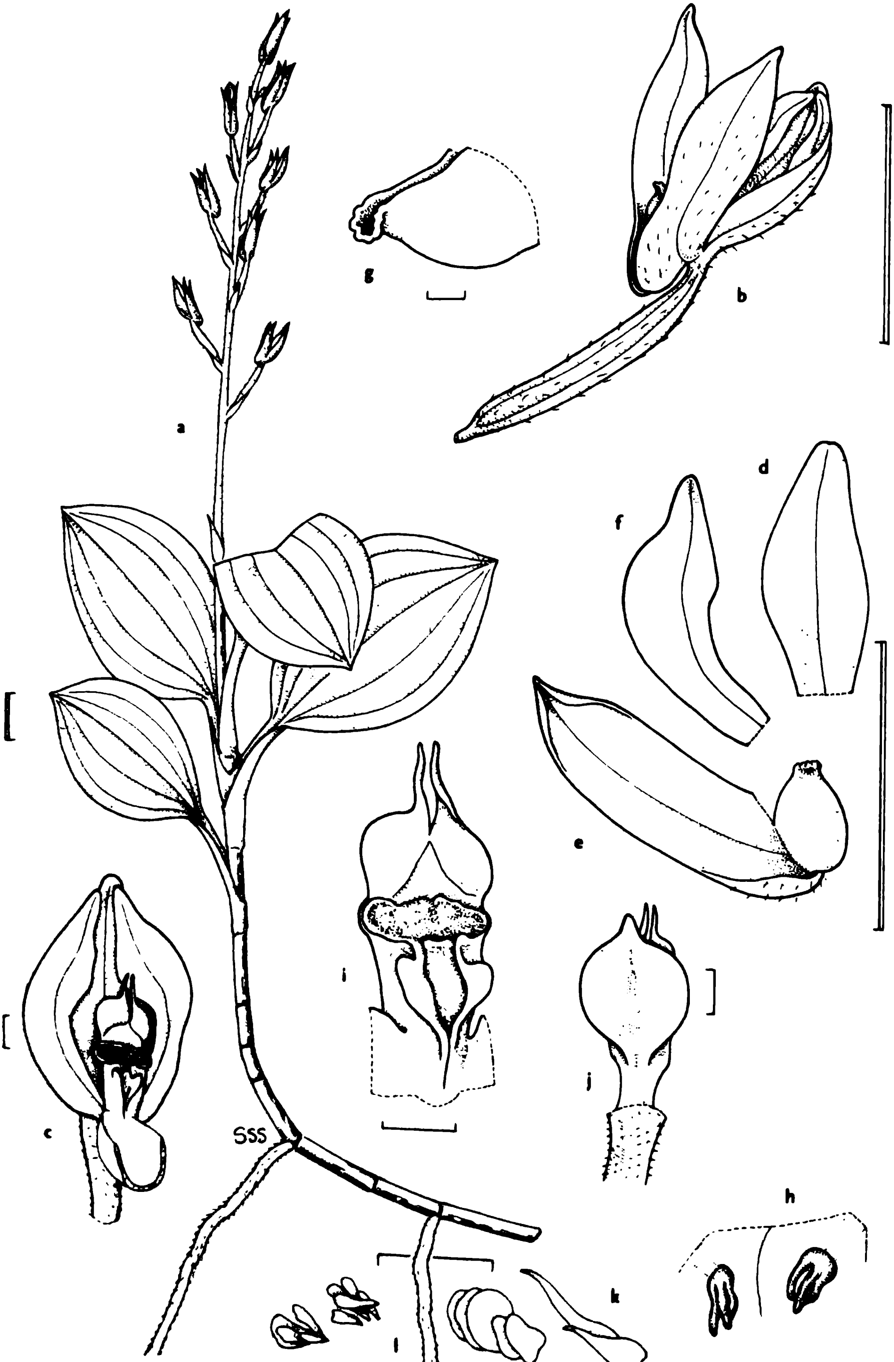


Fig. 24. **Habenaria petala**: a, habit; b, flower and ovary; c, flower (lateral sepals and part of lip removed); d, dorsal sepal; e, lateral sepal and lip; f, petal; g, lip; h, lip (detail of base); i, column (front view); j, column (back view); k, pollinarium (details); l, massulae (details). Drawn by Susanna Stuart-Smith from *Cooper* 2714 (E).

long; rachis densely glandular-pubescent, 8–16cm long; floral bracts lanceolate, acuminate, puberulent, shorter than the ovary, bright purple-red, 0.7–1cm long. *Flowers* to 5mm long; sepals and petals green, tipped with pink, lip green, tipped with yellowish-white, column yellowish-pink, ovaries dull, dark purple; pedicel and ovary glandular-pubescent, 8–9mm long. *Sepals* similar, broadly ovate, 4–5mm long. *Petals* hammer-shaped, clawed, gibbous on one side, 3–4mm long. *Lip* short, subhemispheric, 4–5mm long; base saccate, with a slightly warty callus on each side; apex transverse, more or less bifid. *Column* with 2 small wings ventrally, c.2mm long; anther ovate-cordate, convex; pollinia clavate, longitudinally grooved. Fruit c.1 × 0.7cm.

Bhutan: C – Mongar district (Lhuntse). **Darjeeling** (Rangit); **Sikkim** (Guru Batham ?). In shady, moist forest; 450–900(–3000)m. Fl. January–February.

GENERAL DISTRIBUTION. E Himalaya, Myanmar, China, Thailand and Vietnam.
ETYMOLOGY. From the Latin *affinis* (allied to).
NOTE. Seidenfaden & Ormerod have pointed out that *Goodyera affinis* Griff. is an earlier name for *H. rubens* and therefore has priority.

2. H. pelota N. Pearce & P.J. Cribb in Edinb. J. Bot. 56(2): 278 (1999). Type: Bhutan, Upper Mo Chu district, Gichha (Gasa), R.E. *Cooper* 2714 (holo. E!, iso. BM!).

Plant 15–17cm tall; *rhizome* terete, rooting at nodes; nodes 1–1.8cm apart; roots 1–2mm thick. *Leaves* 4–5, broadly elliptic to elliptic-ovate, acute, petiolate, softly reticulate, 4–7 × 2.5–4cm; petiole widened and sheathing at base, 1–2cm long. *Inflorescence* laxly 6- to 8-flowered; peduncle tapering towards apex, softly pubescent, 9–10cm long; rachis 5–6cm long, somewhat compressed, with few glandular hairs; floral bracts short, triangular, pilose, 3–4mm long. *Flowers* c.8mm long, uniformly white; pedicel and ovary long, 1–1.5cm long. *Dorsal sepal* large, oblong-ovate, obtuse, concave, hooded with petals, 1-veined, 7–8 × 3–4mm; *lateral sepals* oblong, subacute to acute, 1-veined, joining at base of saccate lip, 0.85–1 × 0.25–0.35cm. *Petals* oblong-oblanceolate, falcate, obtuse, 1-veined, 7.5–8.5 × 2.5–3.5mm (at widest point). Lip broadly pyriform in outline, c.5.5mm long; base deeply saccate, connate with column for lower third, with an elongate, stalked, bifurcate callus on either side within; tapering to a slightly expanded, serrate, apex. Column stout, 3.3–5mm long; base with 2 flap-like wings, c.1.5mm long; stigmas 2, merging together at centre; rostellar arms extended upwards; anther hooded, c.3.3 × 2.4mm; anther cap dorsal, orbicular, apiculate, c.3.3 × 2.4mm. **Fig. 24.**

Bhutan: N – Upper Mo Chu district (Gasa). 2330m. Fl. August.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. Named because of a resemblance of the lip to the *cesta* (basket-like racket) used in the game of pelota.
NOTE. *H. pelota* is allied to *H. affinis* but differs in having a lax, few-flowered inflorescence, larger white flowers, and petals which are falcate and not hammer-shaped. The ovary, petals, lip and column are all larger than in *H. affinis* but the plant and leaves are smaller.

24. **Myrmechis** (Lindl.) Bl.

Plants small, terrestrial; *rhizome* creeping. *Stem* short, ascending, leafy. *Leaves* convolute, petiolate. *Inflorescence* few-flowered, terminal, racemose. *Flowers* small, semi-open. *Sepals* free, subequal; dorsal sepal forming a hood with the petals; lateral sepals with an oblique, concave base. *Petals* broadly lanceolate. Lip connate to base of the column, long-clawed; hypochile spathulate, entire at the base with a short pouch; mesochile with incurved or finely serrate margin; epichile recurved, broad. *Column* short; pollinia 2, bifid; stigmas 2, each side of a short, erect rostellum.

The genus *Myrmechis* was established in 1858 by Carl Ludwig Blume in his *Collection des Orchidées les Plus Remarquables de l'Archipel Indien et du Japon*. The name had initially been proposed in 1840 by John

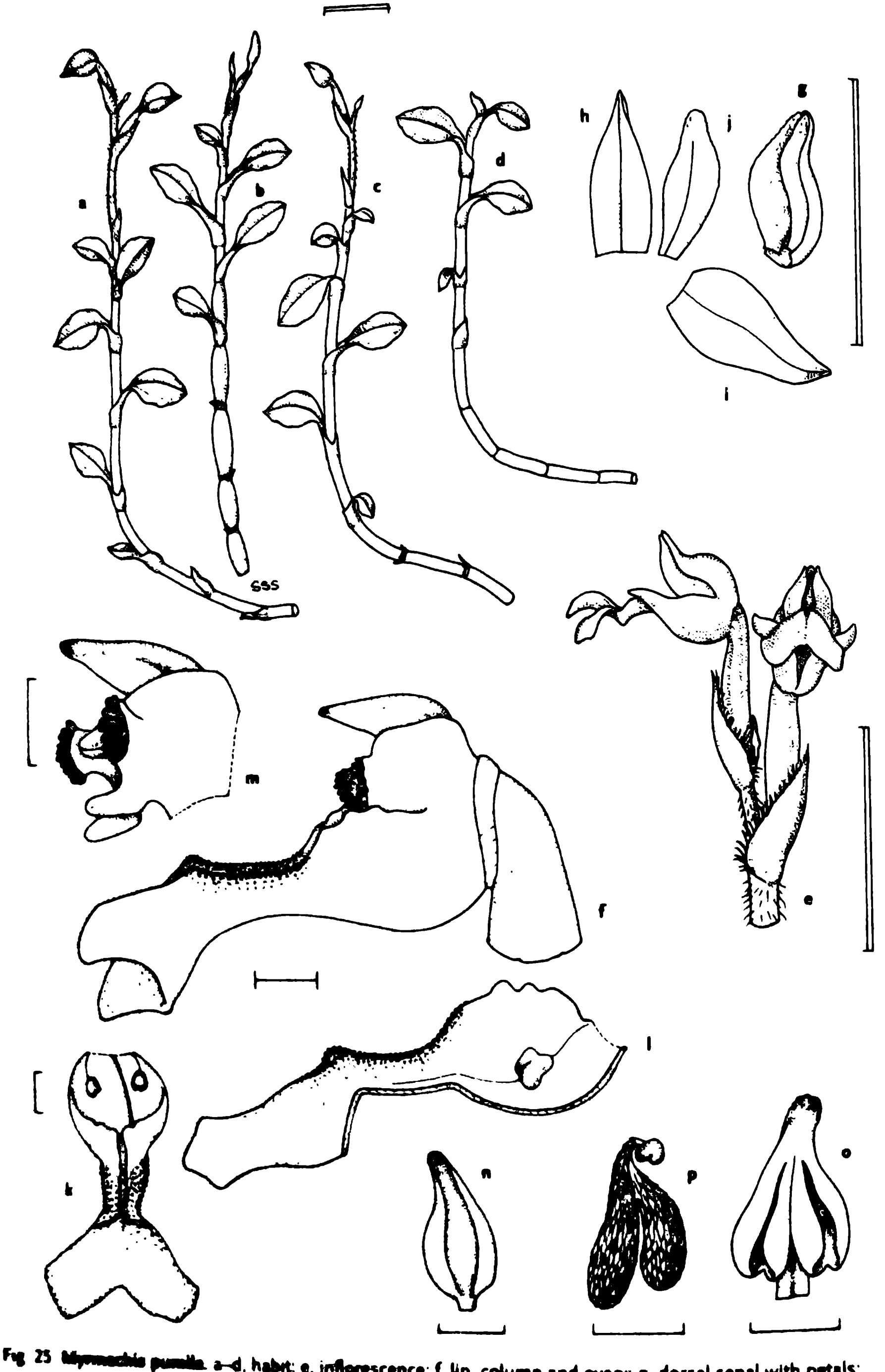


Fig 25 *Myrmechis pumila*. a–d, habit; e, inflorescence; f, lip, column and ovary; g, dorsal sepal with petals; h, dorsal sepal; i, lateral sepal; j, petal; k, lip; l, lip (section); m, column (side view); n, anther (back view); o, anther (front view); p, pollinarium. Drawn by Susanna Stuart-Smith, a, e–p from *Kingdon-Ward* 8469 (K); b–d from *Hooker* 325A (K-LINDL).

Lindley in his *Genera and Species of Orchidaceous Plants* as a section of *Anoectochilus*. The genus comprises about six species distributed from SE Asia to Java.

TYPE. *Myrmechis gracilis* (Bl.) Bl.; basionym: *Anoectochilus gracilis* Bl.
ETYMOLOGY. From the Greek *myrmix* (an ant) possibly a reference to the tiny, ant-like flowers.

1. **M. pumila** (Hook. f.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 69 (1951). Type: India, Sikkim, *Hooker* 325A (holo. K-LINDL!).
Odontochilus pumilus Hook. f., Fl. Brit. India 6(1): 99 (1890).
Cystopus pumilus (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 658 (1891).
Cheirostylis franchetiana King & Pantling in J. Asiat. Soc. Bengal 64(3): 341 (1896). Type: India, Sikkim, Sureil, *Pantling* 338B (holo. CAL, iso. BM! K! W!).
Zeuxine pumila (Hook. f.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 291, t. 389 (1898).
Z. franchetiana (King & Pantling) King & Pantling, *op. cit.* 292, t.398 (1898).
Myrmechis franchetiana (King & Pantling) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 174 (1919).
Anoectochilus pumilus (Hook. f.) Seidenfaden & Smitinand, Orch. Thail. 1: 89 (1959).
Cheirostylis pusilla Lindl. in J. Proc. Linn. Soc., Bot. 1: 188 (1857), *pro minora parte*, non Lindl. 1840.

Plant 7–12cm tall. *Stem* decumbent at base, erect above, 0.5–1mm thick. *Leaves* ovate, acute, margins undulate, 0.7–1.5 × 0.5–0.8cm; petiole sheathing at base, 5–7mm long. *Inflorescence* laxly 2- to 4-flowered; peduncle pubescent, 1.5–2cm long; peduncle with a single lanceolate, acuminate bract, 4–5mm long; floral bracts lanceolate, acute, 4–6mm long. *Flowers* small, 3–6mm long, pure white with a tinge of green on the claw of the lip; pedicel and ovary sessile, linear, pubescent, 6–8mm long. *Sepals* cohering, ovate, 1-veined; *dorsal sepal* concave, apex obtuse, recurved, 5–6 × 2–2.5mm; *lateral sepals* broadly oblique, subacute, 5.5–6.5 × 3mm. *Petals* oblanceolate-oblong, erose, apiculate, 3–4.5 × 2mm. Lip widely saccate at base, 5–6.6 × 5–5.5mm (across base when spread); sac with 2 lateral calluses; mesochile long, narrow, convolute; epichile divided into 2 broad, diverging, obliquely oblong lobes. Column thick, c.1–2mm long; stigmas large, suborbicular. **Fig. 25.**

Bhutan: C – Punakha (Lamperi), Bumthang (Bumthang) and Mongar/Tashigang (Donga La) districts; **Darjeeling** (Sureil); **Sikkim** (Chunthang, Tendong). In dense forest; on moss and large boulders in *Abies* forest; 1800–3600m. Fl. July–September.

GENERAL DISTRIBUTION. NE India, Thailand, Myanmar and China (Yunnan).
ETYMOLOGY. From the Latin *pumilus* (dwarf) in reference to the inconspicuous habit.
NOTES. In 1840 Lindley described *Cheirostylis pusilla* based on a Wallich collection (no. 7382). He later (Lindley, 1857) included additional collections from Sikkim (*Hooker*) and Khasia (*Griffith*) in his concept of the species. Hooker, however, realised that his Sikkim specimen was not a *Cheirostylis*, because its sepals were not connate to the middle, the epichile lobes were untoothed and the column had no extended stelidia. He therefore described the Sikkim plant as *Odontochilus pumila*, which has since been transferred to *Myrmechis*. The two species are vegetatively very similar and, because of their size, virtually impossible to separate without microscopic examination.

25. Odontochilus Bl.

Plants terrestrial. *Stems* leafy, ascending to erect, *rhizomes* decumbent, rooting at nodes. *Leaves* cauline, distant, few, petiolate, usually green on both surfaces. *Inflorescence* a laxly flowered spike or raceme. *Flowers* often showy. *Sepals* and *petals* free; lateral sepals spreading, oblique; petals connivent with dorsal sepal to form a hood. Lip 3-lobed, adnate to the column base, spreading; hypochile saccate, rounded to globose, enclosed by, or shorter than, the lateral sepals; mesochile channelled, long to shortly fimbriate-toothed; epichile unlobed or with a divergent 2-lobed blade; glands in spur not peltate, fleshy-linear. Column short, fleshy in front, winged or keeled, elongate; rostellum elongate, twisted; anther versatile; stigmas 1 or 2, ventral, under the rostellum; pollinia 2, granular.

The genus *Odontochilus* was established in 1858 by Carl Ludwig Blume in his *Collection des Orchidées les Plus Remarquables de l'Archipel Indien et du Japon*. The genus comprises about 20 species distributed in tropical Asia, Malaysia, Polynesia and adjacent islands.

The taxonomic problems of the genera *Anoectochilus* and *Odontochilus* have been discussed in the introduction to *Anoectochilus* and, as explained there, we consider them to be distinct.

TYPE. *non designatus*.
ETYMOLOGY. From the Greek *odonton* (furnished with teeth) and *cheilos* (a lip) in reference to the fringed tooth-like margins of the mesochile of the lip.

Key to species

1.	Mesochile of lip not toothed or pectinate	**2. O. crispus**
+	Mesochile of lip toothed or pectinate	2
2.	Leaves lanceolate; lip yellow	3
+	Leaves ovate-elliptic; lip white	4
3.	Base of mesochile of lip dilated	**1. O. clarkei**
+	Base of mesochile of lip not dilated	**5. O. lanceolatus**
4.	Plant more than 30cm tall; leaves more than 8cm long and 3cm wide	**4. O. grandiflorus**
+	Plant less than 20cm tall; leaves less than 7cm long and 3.5cm wide	5
5.	Sac of lip with a longitudinal septum; stigmas 2	**3. O. elwesii**
+	Sac of lip without a longitudinal septum; stigma 1	**6. O. tortus**

1. **O. clarkei** Hook. f., Fl. Brit. India 6(1): 100 (1890); Icon. Pl. 22: t.2168 (1894). Type: India, Darjeeling, Mongpu, *Clarke* 26741 (holo. K!).
Anoectochilus clarkei (Hook. f.) Seidenfaden & Smitinand, Orch. Thail.: 88 (1959).
Cystopus clarkei (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 658 (1891).

Plant to 30cm tall. Stem erect, c.10cm tall. *Leaves* 3–4, towards top of the stem, lanceolate to ovate-lanceolate, acute, petiolate, reticulate, 3–6.5 × 1.5–3cm; petiole glandular-pubescent, expanded at base, sheathing, 1–2cm long. *Inflorescence* racemose, many-flowered; peduncle glandular-pubescent, c.8cm long; rachis c.12cm long; floral bracts lanceolate, acute, 1–1.2cm long. *Flowers* c.1.5 × 1cm wide at apex; sepals and petals greenish pink, lip yellow; pedicel and ovary glandular-pubescent, 0.8–1cm long. *Sepals* similar, ovate-oblong, 1-veined, c.8 × 4mm. *Petals* ovate-oblong, connivent with the dorsal sepal, c.8 × 4mm. *Lip* 3-lobed, c.1cm long; hypochile saccate, 2 caruncles within; mesochile expanded basally into an orbicular to obcordate plate, 3-toothed below; epichile divided into 2 wedge-shaped wings. *Column* c.2mm long; anther beaked; rostellum elongate.

Darjeeling (Mongpu). 900–1500m. Fl. and Fr. August.

GENERAL DISTRIBUTION. E Himalaya and S China.
ETYMOLOGY. Named after Charles Baron Clarke (1832–1906), a British botanist who collected plants in India between 1865 and 1887, and contributed to the *Flora of British India*.
NOTE. *O. clarkei* is very closely related to *O. lanceolatus* but differs in having a characteristically dilated mesochile base. Hooker (1890) commented that it was 'the only species with a dilated base of the claw of the lip'.

2. O. crispus (Lindl.) Hook. f., Fl. Brit. India 6(1): 99 (1890). Type: India, Sikkim, icon. Cathcart s.n. (holo. K!).

Anoectochilus crispus Lindl. in J. Proc. Linn. Soc., Bot. 1: 180 (1857).

Cystopus crispus (Lindl.) Kuntze, Revis. Gen. Pl. 2: 658 (1891).

Plant 12–20cm tall. *Stems* decumbent at base, slender, 6–10cm long. *Leaves* 2–4, at top of stem, ovate, acute, petiolate, margins minutely undulate, 1–3 × 1–2cm; petiole dilated at base, 0.5–1.5cm long. *Inflorescence* 4- to 8-flowered; peduncle pubescent, shorter than the stem, sheathed, 3.5–4cm long; sheaths 1 or 2, lanceolate, acuminate, pubescent, 5–6mm long; rachis 2–5cm long; floral bracts lanceolate, acuminate, pubescent, 0.6–1cm long. *Flowers* up to 1.6cm long; sepals green, petals white and lip white tinged with yellow; pedicel and ovary glabrous, 0.6–1cm long. *Sepals* subequal, pubescent dorsally, 1-veined; *dorsal sepal* convex, apex upturned, 6–7 × 2–3mm; *lateral sepals* spreading, oblong, oblique, 6–8 × 4–5mm long. *Petals* triangular-falcate connivent with dorsal sepal, 4–5mm long. *Lip* deflexed from the base, 1–1.5 × 0.9–1.1cm (across epichile when spread); hypochile saccate, sac small, globose with 2 large, subquadrate, erose lamellae within; mesochile narrow, untoothed; epichile suborbicular, divided by a narrow sinus into 2 broad lobules, margins undulate and minutely crenulate-dentate. *Column* 2–2.3mm long; anther beaked; pollinia subglobose; rostellar arms short; pollinaria c.4mm long. **Fig. 26.**

Bhutan: S – Samchi district (Kalapani); C –Tashigang district (Rocha Chu to Tashi Yangtsi); **Darjeeling** (Mahaldiram Mountain, Mongpu); **Sikkim** (Latha?). Under open oak forest, shady secondary forest, in bamboo forest; 360–2400m. Fl. (March–)August–October.

GENERAL DISTRIBUTION. E Himalaya and China.

ETYMOLOGY. From the Latin *crispus* (irregularly waved and twisted) in reference to the fringed lobules of the epichile.

NOTE. *O. crispus* is the only member of the genus in the region with a toothless mesochile.

3. O. elwesii C.B. Clarke ex Hook. f., Fl. Brit. India 6(1): 100 (1890); Icon. Pl. t.2167 (1894). Types: India, Darjeeling, Rishap, *Clarke* 12251 (syn. K!); Khasia Hills, Shillong, *Clarke* 44609 (syn. K!); Munnipore, Kohima, Naga Hills, *Prain* 17 (syn. K!).

Cystopus elwesii (C.B. Clarke ex Hook. f.) Kuntze, Revis. Gen. Pl. 2: 658 (1891).

Anoectochilus elwesii (C.B. Clarke ex Hook. f.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 296, t.394 (1898).

Odontochilus purpureus C.S. Leou in Quart. J. Expt. Forest Nat Taiwan Univ. 6(3): 68 (1992). Type from Taiwan.

Anoectochilus purpureus (C.S. Leou) S.S. Ying, Col. Illust. Orch. Fl. Taiwan 1: 62 (1996).

Plant 20–30cm tall. *Stem* stout, glabrous, decumbent at base, 7–10cm long. *Leaves* 4–7, ovate, acute, 3-veined, 2–5 × 1–2cm, margins hyaline, brown; petiole 0.8–1cm long, expanded at base. *Inflorescence* racemose, 2- or 3-flowered; peduncle glandular-pubescent, with distant sheaths, 6–10cm long; sheaths lanceolate, acuminate, c.1cm long; floral bracts lanceolate, acuminate, glandular-pubescent, 0.9–1.3 × 0.3–0.4cm. *Flowers* to 2.5cm long; sepals green with white veins and brown apex, petals white, brown-tipped, lip white with brown teeth; pedicel and ovary pubescent, 0.9–1.1cm long. *Dorsal sepal* ovate-cordate, subacute, c.7mm long; *lateral sepals* broadly oblong, weakly falcate, obtuse, diverging, 7–8mm long. *Petals* broadly oblong, falcate, acute, 1-veined, c.8mm long. *Lip* 3-lobed, 1.5–2 × 1–1.4cm (at epichile when spread); hypochile saccate, with 2 conical calluses; mesochile pectinate; epichile 2-lobed, divided by a broad sinus, lobes oblong-oblique. *Column* stout with 2 appendages at base, c.2mm long; stigmas 2; anther beaked.

Bhutan: S – Sankosh district (above Daga Dzong, E of Daga River); C – Tashigang district (Tashi Yangtsi); **Darjeeling** (Rishap); **Sikkim** (Chuntang). In hot, damp valleys and open glades in moist, shady broad-leaved forest; 2100–2400m. Fl. July–August.

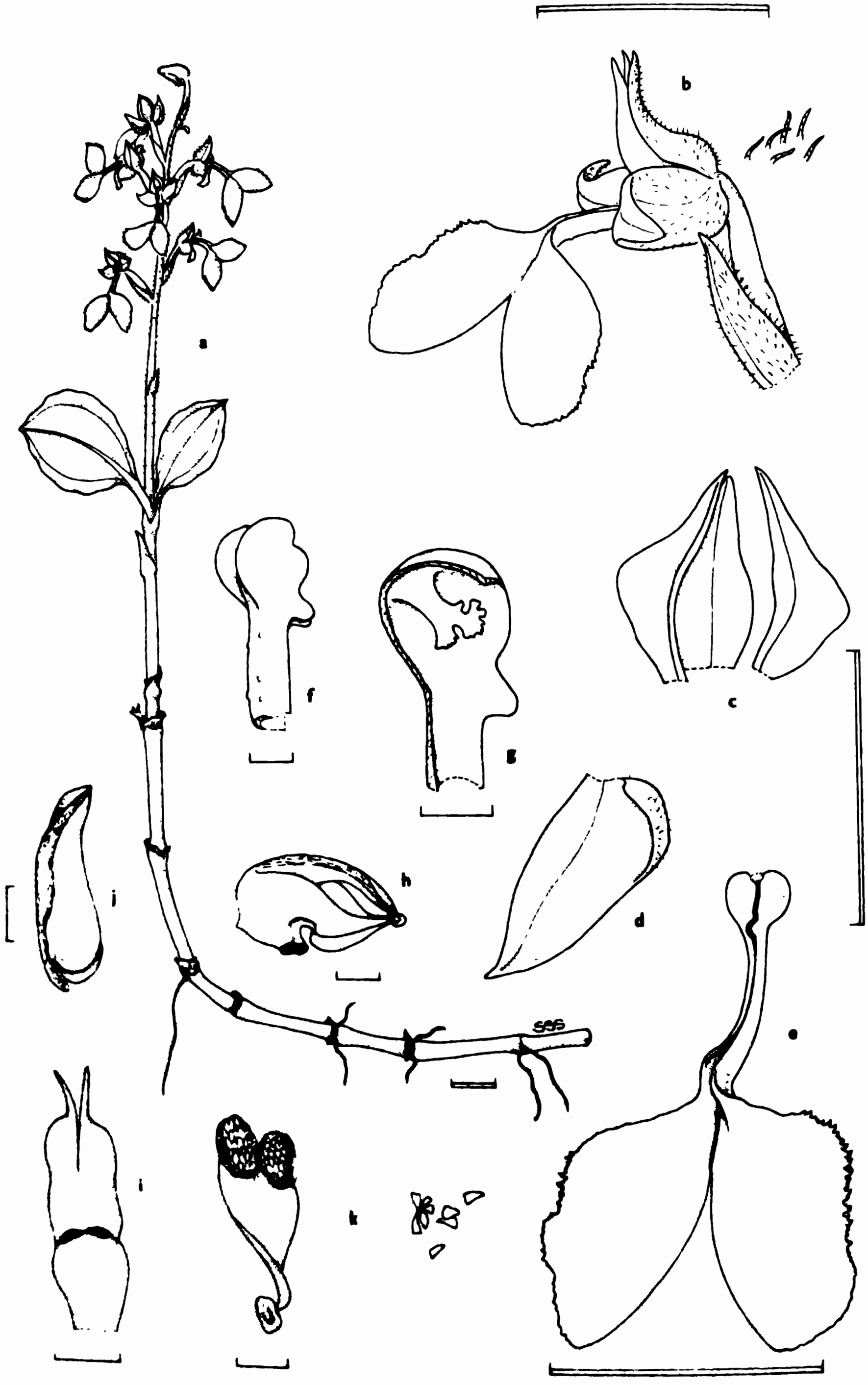


Fig. 26. **Odontochilus crispus**: a, habit; b, flower with detail of hairs; c, dorsal sepal and petals; d, lateral sepal; e, lip, f, lip base (detail), g, lip base (longitudinal section); h, column; i, column apex; j, anther cap; k, pollinarium with massulae. Drawn by Susanna Stuart-Smith, a from *Clarke* 36364 (K); b–k from *Clarke* 27345 (K).

GENERAL DISTRIBUTION. NE India and China (Sichuan).
ETYMOLOGY. Named after Henry John Elwes (1846–1922) who was an arboriculturist, naturalist and sportsman who travelled and collected plants in Asia.

4. **O. grandiflorus** (Lindl.) Bentham & Hook. f. ex Hook. f., Fl. Brit. India 6(1): 100 (1890). Types: India, Sikkim, *Hooker* 329 (syn. K-LINDL!); Khasia, *Hooker* & *Thomson* s.n. (syn. K!).
Anoectochilus grandiflorus Lindl. in J. Proc. Linn. Soc., Bot. 1: 179 (1857).
Cystopus grandiflorus (Lindl.) Kuntze, Revis. Gen. Pl. 2: 658 (1891).

Plant 30–45cm tall. *Stem* decumbent, glabrous; *roots* stout, pubescent, up to 5mm thick. *Leaves* elliptic to broadly elliptic, oblique, many-veined, petiolate, green, 4–9.5 × 2–5.5cm; petiole 1.5–4.5cm long. *Inflorescence* laxly many-flowered; peduncle sparsely pubescent, 5–6.5cm long, with 2–3 ovate sheaths; rachis laxly pubescent; floral bracts ovate-lanceolate, convolute, c.1 × 0.3cm. *Flowers* showy, 1.5–2.5cm long; sepals and petals pale green, mottled white and tipped with pink, lip white, mesochile teeth green, sac tinged yellow; pedicel and ovary 1–1.5cm long. *Sepals* subsimilar, glabrous, 7–9mm long; *dorsal sepal* ovate, concave; *lateral sepals* spreading, oblong, falcate, subacute, connate at base. *Petals* falcate-oblanceolate, bluntly acuminate, 6–9mm long. *Lip* 3-lobed, 1.5–2cm long; hypochile saccate, with 2 subquadrate calluses, decurrent on the ovary; mesochile long-pectinate; epichile 2-lobed, lobes divergent, oblong, apices truncate-erose. *Column* 5–6mm long; rostellum bifid; stigmas 2, conjoined.

Sikkim (Tendong). 1200m. Fl. July.

GENERAL DISTRIBUTION. E Himalaya.
ETYMOLOGY. From the Latin *grandi-* (large) and *-florus* (flowered).

5. **O. lanceolatus** (Lindl.) Bl., Coll. Orchid.: 80, t.29 (1858). Types: India, Assam, *Mack* s.n. (syn. K!); India, Khasia, Mishmee Hills, *Griffith* s.n. (syn. K!).
Anoectochilus lanceolatus Lindl., Gen. Sp. Orchid. Pl.: 499 (1840).
A. luteus Lindl. in J. Proc. Linn. Soc., Bot. 1: 179 (1857). Types: India, Sikkim, icon. Cathcart s.n. (syn. K!); Sikkim, *Hooker* 341 p.p. (syn. K-LINDL!).
Cystopus lanceolatus (Lindl.) Kuntze, Revis. Gen. Pl. 2: 658 (1891).
Odontochilus yunnanensis Rolfe in J. Linn. Soc., Bot. 36: 43 (1903). Type: China, Yunnan, Mengtze, *Henry* 11110 (holo. K!).
Anoectochilus bisaccatus Hayata, Icon. Pl. Formos. 4: 99, t.15 (1914). Type from Taiwan.
A. densiflorus Mansfeld in Feddes Repert. Spec. Nov. Regni Veg. 27: 294 (1930). Type: China, Kwangsi, S. Sin 3856 (holo. B).
Odontochilus densiflorus (Mansfeld) T. Tang & F.T. Wang ex Merrill & Metcalf in Lingnan Sci. J. 21: 12 (1945).
Pristiglottis bisaccatus (Hayata) Nackejima in Biol. Mag. 13: 3 (1975).

Plant 13–40cm tall. *Stem* glabrous, decumbent at base, 12–22cm long. *Leaves* ovate-lanceolate, acute, petiolate, distant along stem, green with white veins, 2–6 × 1–1.5cm; petiole 2–2.5cm long, base expanded, tubular. *Inflorescence* laxly many-flowered; peduncle short, pubescent; peduncle sheaths 1 or 2, ovate-lanceolate, acuminate, 0.6–1.2cm long; rachis pubescent, 4–12cm long; floral bracts ovate-lanceolate, acuminate, 0.5–1.5 × 0.2–0.3cm. *Flowers* up to 2cm long; sepals and petals pale green, dorsal sepal tinged with brown, lip yellow, anther pink; pedicel and ovary 0.5–1cm long. *Dorsal sepal* ovate, acute, 5–7 × c.2mm; *lateral sepals* ovate-oblong, obtuse, spreading, 1-veined, 5–7 × 2–3mm. *Petals* reniform, acuminate, connivent with dorsal sepal to form a hood, 3–5 × 1–2mm. *Lip* 3-lobed, 0.7–1cm long; hypochile saccate with 2 spur-like processes; mesochile pectinate; epichile 2-lobed, lobes diverging, obliquely truncate. *Column* stout, 1–2mm long; rostellum broad; anther beaked; stigmas 2, lateral. *Fruit* fusiform, sessile, erect, 1–1.2 × 0.3–0.5cm.

Bhutan: S – Chukka district (Sinchula); C – Punakha district (Neptengka, Rimchu, Tinlegang); **N** – Upper Mo Chu district (Kencho); **Terai** (unlocalised *Gamble* specimen); **Darjeeling** (Rishap, Sitong); **Sikkim** (Nanga, Lukrap, Rimbi Chhu, Yoksam). On shaded rocks, in damp broad-leaved forest; 1500–2100m. Fl. August–September.

GENERAL DISTRIBUTION. Nepal, NE India, China and Vietnam.
ETYMOLOGY. From the Latin *lanceolatus* (lanceolate) in reference to the leaf shape.
NOTE. *O. lanceolatus* is closely related to *O. clarkei* - both have a yellow lip, but the former lacks a dilated mesochile base.

6. **O. tortus** King & Pantling in J. Asiat. Soc. Bengal 65(2): 125 (1896). Type: India, Darjeeling (Duars), Kumai, *Pantling* 354 (holo. CAL, iso. BM! K!).
Anoectochilus tortus (King & Pantling) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 298, t.396 (1898).

Plant 15–18cm tall. *Stem* decumbent at base, stout, c.8cm tall. *Leaves* 4–6, green, 3-veined, ovate-lanceolate, acute, slightly oblique, narrowed at base into a channelled, sheathing petiole, 4–7 × 1.8–3cm; petiole 1.5–3cm long. *Inflorescence* 3- to 6-flowered; peduncle pubescent, with a solitary, acuminate, pubescent sheath, c.4cm long; rachis 3.5–7cm long; floral bracts lanceolate, acuminate, thinly pubescent, 1–1.3 × 0.3–0.4cm. *Flowers* up to 2cm long; sepals and petals green, lip white, anther pale brown; pedicel and ovary pubescent, 1–1.2cm long. *Dorsal sepal* broad, ovate, concave, forming a hood with the petals covering the column, c.1 × 0.4cm; *lateral sepals* oblong, blunt, spreading, dorsally pubescent, 0.8–1 × c.0.3cm. *Petals* falcately rhombic, subacuminate. *Lip* with a short, subglobose sac at base and 2 short upturned teeth, 1.2–1.6cm long; mesochile with 9 pairs of long teeth; epichile twisted, deeply divided into 2 subquadrate, slightly divergent lobes, margins irregularly crenate, upper margins connivent. *Column* with 2 small upturned teeth below the entire stigma, 2–4mm long; rostellar arms large, winged, bidentate.

Duars (Kumai). 1200m. Fl. November–December.

GENERAL DISTRIBUTION. E Himalaya and China.
ETYMOLOGY. From the Latin *tortus* (twisted) in reference to the epichile of the lip.
NOTES. *O. tortus* is most closely related to *O. elwesii* but that species has dark purple leaves and the lip epichile is not twisted. *O. tortus* has a single stigmatic lobe which clearly makes its inclusion in section *Diplostigmata* incorrect, but we retain it here until the taxonomy of the subtribe has been reviewed.

26. **Rhomboda** Lindl.

Plants terrestrial; *rhizome* creeping; roots fleshy, villose, arising from nodes. *Stem* erect, leafy. *Leaves* obliquely lanceolate to elliptic-suborbicular, acute, greenish-red, sometimes suffused with bronze; petiole widened into a sheath around the stem. *Inflorescence* terminal, racemose, few- to many-flowered; floral bracts sparsely pubescent. *Flowers* resupinate or non-resupinate, ± pendent. *Sepals* ovate-elliptic; *lateral sepals* spreading. *Petals* forming a hood with dorsal sepal, membranous. *Lip* 3- or 4-lobed; hypochile forming largest part of lip, partly connate with column margin, with a single rhombic-elliptic basal appendage each side; lateral lobes truncate, rounded; mesochile short or absent; epichile sessile to clawed, entire to 2-lobed, apiculate. *Column* clavate, winged; rostellum slender; stigmas 2; pollinia 2, clavate, sectile.

The genus *Rhomboda* was established in 1857 by John Lindley in the *Journal of the Linnaean Society*. It was originally described as a monotypic genus but the type, *R. longifolia* Lindl., was transferred by Bentham to *Hetaeria* and, later, by Hooker (1890) to *Zeuxine*. Ormerod (1995) reinstated the genus and reviewed its generic affinities, limits and characteristics, clarifying some of the taxonomic confusion within the subtribe. The genus comprises about 22 species distributed in Nepal, NE India, Bhutan, SW China, Myanmar, Thailand, Malaysia, Indonesia, New Guinea, the Solomon Islands and NE Australia.

TYPE. *Rhomboda longifolia* Lindl.
ETYMOLOGY. From the Greek *rhombicus* (diamond-shaped) in reference to the calluses of the lip of the type species.

Key to species

1. Leaves less than 10cm long; lobes of lip epichile entire .... 1. **R. lanceolata**
+ Leaves more than 10cm long; lobes of lip epichile lacerate at apex .... 2. **R. longifolia**

1. **R. lanceolata** (Lindl.) Ormerod in Orchadian 11(7): 329 (1995). Type: India, Khasia, Pomrang, *Hooker* & *Thomson* s.n. (holo. K!, icon. K!, K-LINDL!).
Dossinia lanceolata Lindl. in J. Proc. Linn. Soc., Bot. 1: 186 (1857).
Macodes lanceolata (Lindl.) Rchb. f., Xenia Orchid. 1: 226 (1858).
Hetaeria lanceolata (Lindl.) Rchb. f. in Trans. Linn. Soc. London 30: 142 (1874).
Zeuxine abbreviata sensu Hook. f., Fl. Brit. India 6(1): 109 (1890); Icon. Pl. 22: t.2178 (1894), non (Lindl.) Hook. f.
Anoectochilus pomrangianus Seidenfaden in Dansk Bot. Ark. 32(2): 41 (1978), *nom. nov.*
Odontochilus pomrangianus (Seidenfaden) Szlachetko in Fragm. Florist. Geobot. Suppl. 3: 115 (1995).

Plant erect, 10–25cm tall. *Stem* glabrous, 9–10cm tall, with nodes 1.5–2cm apart. *Leaves* 3–4, lanceolate, acute, petiolate, 3–6 × 1.5–2cm; petiole sheathing and expanded at base, c.2.5cm long. *Inflorescence* laxly 10- to 14-flowered; peduncle 7.5–8cm long, bearing sheaths; sheaths 2 or 3, lanceolate, acute, 0.8–1.4cm long; rachis 5–6cm long; floral bracts lanceolate, margins pubescent, 3–9mm long. *Flowers* subglobose, c.3mm long; sepals pale brown, petals white, lip white with a pale yellow base; pedicel and ovary twisted, 6–9mm long. *Sepals* similar, ovate, acute, 1-veined, 3.8–4.5 × 2.3–2.5mm. *Petals* obliquely ovate, subacute, 1-veined, 4 × 1.8mm. *Lip* exceeding the sepals, saccate at base, 4–4.5 × 3mm; sac with 2 lamellae towards the midrib and a large callus on each side behind the lamellae; apex decurved, 2-lobulate, obliquely ovate, with a central apiculus. *Column* thick, 2–3mm long; pollinia elongate, clavate, c.2mm long. **Fig. 27.**

Darjeeling (Ambyok). 1500m.

GENERAL DISTRIBUTION. India (Khasia), Malaysia, Sumatra, Sulawesi and the Philippines.
ETYMOLOGY. From the Latin *lanceolatus* (lanceolate) in reference to the leaf shape.
NOTE. Hooker (1890) and King & Pantling (1898) incorrectly identified this plant as *Zeuxine abbreviata*.

2. **R. longifolia** Lindl. in J. Proc. Linn. Soc., Bot. 1: 181 (1857). Type: India, Sikkim, *Hooker* 335 (holo. K!).
Hetaeria longifolia (Lindl.) Bentham ex. Hook. f., Fl. Brit. India 6(1): 109 (1890), *pro syn.*
Zeuxine longifolia (Lindl.) Hook. f., Fl. Brit. India 6(1); 109 (1890); Icon. Pl. 22: t.2180 (1894).
Odontochilus longifolius (Lindl.) T. Tang & F.T. Wang in Acta. Phytotax. Sin. 1(1): 70 (1951).

Plant 30–35cm tall. *Stem* up to 6mm thick, decumbent, nodes up to 2.2cm apart. *Leaves* to 5, lanceolate, acute, reticulate, petiolate, 13–19 × 3–5cm; petiole expanded and sheathing at base, 3–5cm long. *Inflorescence* laxly many-flowered; peduncle sheathed at intervals of c.4.5cm; sheaths ovate-lanceolate, acute, c.1.5cm long; rachis c.16cm long; floral bracts ovate-lanceolate, acute, finely pubescent, 0.8–1.1cm long. *Flowers* up to 5mm long; pedicel and ovary 1–1.2cm long. *Sepals* subsimilar, ovate-lanceolate, acute, c.6 × 3mm. *Petals* falcate, lanceolate, c.6mm long. *Lip* 3-lobed, c.6mm long; hypochile suborbicular, saccate; mesochile lacking teeth; epichile 2-lobed, margins fringed; sac with 2 rhomboidal basal appendages, divided longitudinally by a low keel rising to a fleshy 2-keeled callus towards apex. *Column* winged, 2–3mm long; stigmas 2; rostellum slender, bifid; pollinia 2, clavate.

Sikkim (unlocalised *Hooker* specimen).

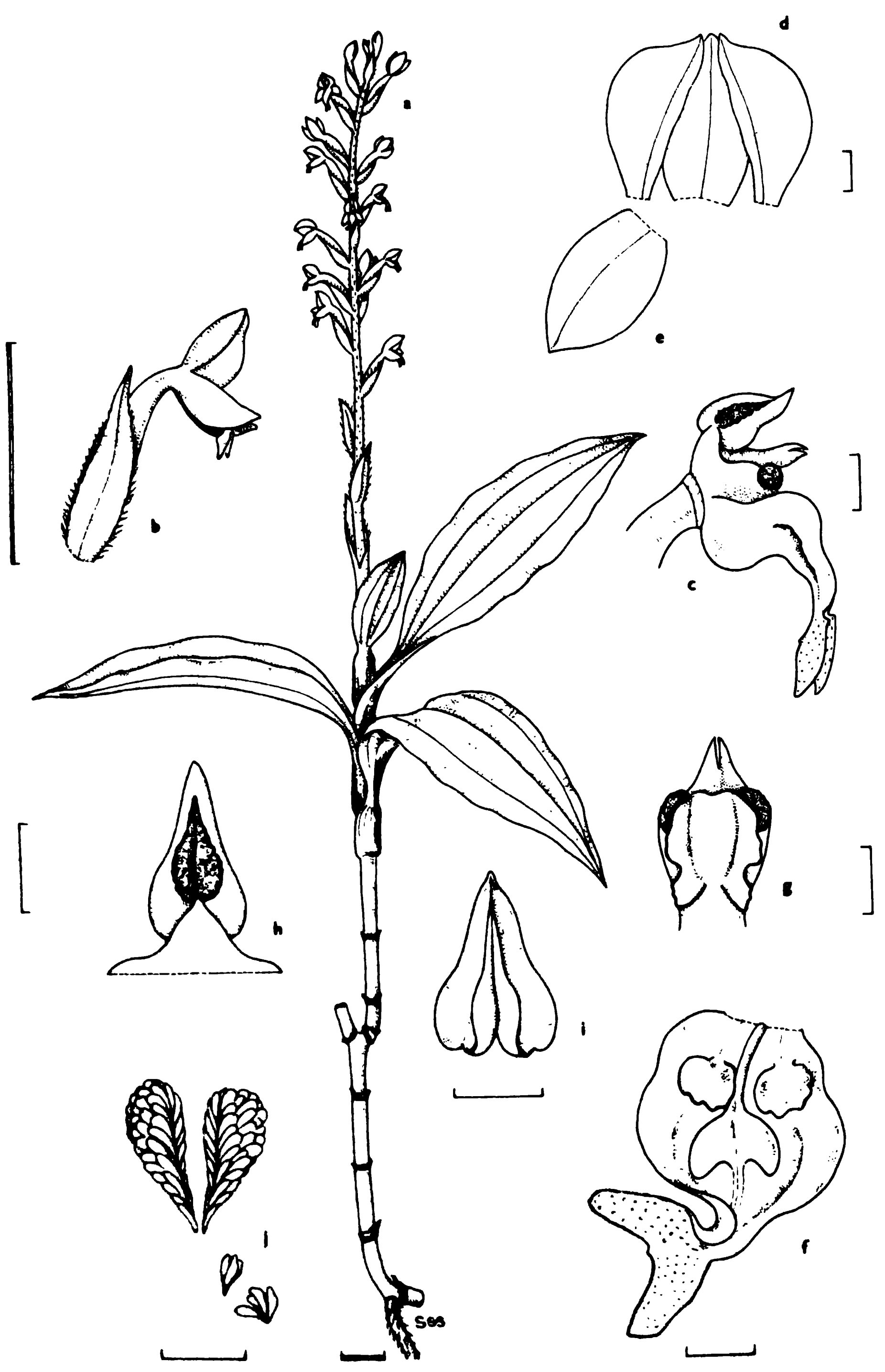


Fig. 27. **Rhomboda lanceolata**: a, habit; b, flower; c, lip and column (side view); d, dorsal sepal and petals; e, lateral sepal; f, lip; g, column apex; h, anther (back view); i, anther (front view); j, pollinia, with massulae. Drawn by Susanna Stuart-Smith from *Hooker & Thomson* s.n. (K).

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *longus* (long) and *folius* (leaf).
NOTE. This species has not been refound since it was originally collected by Hooker.

Species reported from the Kameng district of Arunachal Pradesh but not from Bhutan.

R. arunachalensis A.N. Rao in J. Econ. Taxon. Bot. 22(2): 426 (1998). Type: India, Arunachal Pradesh, Kimi, *A.N. Rao* 29426 (holo. Orchid Herbarium Tipi).

NOTE. Related to R. *wardii* Ormerod from Myanmar, but differing in having a pubescent ovary and sepals, and epichile lobes which are transversely sub-rectangular.

27. **Zeuxine** Lindl.

Plants terrestrial, small to medium; *rhizome* creeping, fleshy, rooting at nodes; stems short, remote, leafy. *Leaves* fleshy, broad to linear, often petiolate. *Inflorescence* terminal, racemose, laxly to densely few- to many-flowered. *Flowers* usually small, resupinate, tubular or subcampanulate, often glandular-pubescent. *Dorsal sepal* erect; *lateral sepals* spreading. *Petals* smaller than the sepals, usually hyaline, adnate to the dorsal sepal to form a hood over the column. *Lip* more or less adnate to the base and sides of the column, 3-lobed; hypochile saccate, enclosing 2 glands; mesochile linear, claw-like; epichile transversely oblong to reniform. *Column* porrect, short, lacking wings or keels; rostellum elongate, bifid at apex; pollinia 2, deeply divided, granular; stigma 2.

The genus *Zeuxine* was established in 1826 by John Lindley in the Appendix to his *Collectanea Botanica*. In 1840, in *Genera and Species of Orchidaceous Plants*, Lindley proposed two sections: *Eu-zeuxine* in which the lateral sepals are connate and the dorsal sepal is saccate at the base, and *Cionisaccus* in which the sepals are free and the dorsal sepal is convex at the base. The genus comprises about 70 species distributed in the tropics and subtropics of the Old World with a single species introduced into N America.

Seidenfaden (1978a) revised the Thai species and a full synonymy of the widespread species may be found there. Hashimoto (1986) established *Heterozeuxine* as a new genus and transferred Z. *nervosa* (Wall. ex Lindl.) Bentham ex C.B. Clarke and Z. *odorata* Fukuyama to it. Its characteristic features are based upon column and pollinaria morphology. In 1987 he also transferred Z. *glandulosa* and noted that 'the details of columnar morphology, as the author described, are not fully recorded on every species of the group'. We await a full monographic treatment before accepting this genus.

TYPE. *Zeuxine sulcata* (Roxb.) Lindl.; basionym: *Pterygodium sulcatum* Roxb.
ETYMOLOGY. From the Greek *zeuxis* (to yolk in pairs, unite) in reference to the partial union of the column and lip.

Key to species

1. Leaves linear, grass-like 2
+ Leaves not linear or grass-like 3

2. Plant usually more than 22cm tall; ovary pubescent; petals not adnate to the dorsal sepal .... **5. Z. membranacea**
+ Plant less than 22cm tall; ovary glabrous; petals adnate to the dorsal sepal . **9. Z. strateumatica**

3. Epichile of lip entire, not divided into 2 lobes .... **4. Z. goodyeroides**
+ Epichile of lip 2-lobed 4

4. Column with 8 vertical, tooth-like projections; stigmas united to form a narrow band .... **7. Z. pulchra**
+ Column lacking tooth-like projections; stigmas distinct 5

5. Column with distinctly projecting vertical wings ventrally 6
+ Column with indistinct, low, vertical wings ventrally 8

6. Lip white .... **3. Z. glandulosa**
+ Lip yellow 7

7. Petals oblong-ovate, not narrowing suddenly towards the apex; sepals less than 4mm long; leaves lacking silver-grey blotches or a broad median line .... **2. Z. flava**
+ Petals oblique, broad in the middle, narrowing suddenly towards the apex; sepals more than 4mm long; leaves with silver-grey blotches or a broad median line .... **6. Z. nervosa**

8. Column processes vertical .... **1. Z. affinis**
+ Column processes horizontal .... **8. Z. reflexa**

1. Z. affinis (Lindl.) Bentham ex Hook. f., Fl. Brit. India 6(1): 108 (1840). Type: Myanmar (Burma), Taong Dong, on River Mytinge, coll. *Wallich* Wall. Cat. 7383 (holo. K-LINDL!, iso. K-W!).

Etaeria affinis Lindl. in Wall. Cat.: 7383 (1832), *nom. nud.*

Monochilus affine Lindl., Gen. Sp. Orchid. Pl.: 487 (1840).

Aetheria mollis Lindl. in J. Linn. Soc., Bot. 1: 184 (1857). Type: India, Khasia, *Hooker & Thomson* 343 (holo. K-LINDL!).

Zeuxine arisanensis Hayata, Icon. Pl. Formos. 4: 106, t.55 (1914). Type from Taiwan.

Adenostylis arisanensis (Hayata) Hayata, Icon. Pl. Formos. Suppl. 6: 75 (1917).

Zeuxine aurantiaca Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 19: 377 (1924). Type: China, Yunnan, *Forrest* 11914 (holo. E).

Z. sutepensis Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 413 (1925). Type from Thailand.

Plant 12–30cm tall. *Stem* stout, bearing several hyaline sheaths, c.10cm tall. *Leaves* ovate-lanceolate, petiolate, brown during flowering, 1–3.5 × 0.6–1cm long; petiole short, slender, expanded at base to large hyaline sheath, 0.5–1cm long. *Inflorescence* laxly to subdensely 5- to 15-flowered; peduncle sparsely pubescent, 7–12cm long, sheathed; sheaths 2, distant, membranous, acuminate, c.5mm long; rachis 3–7.5cm long; floral bracts broadly lanceolate, pubescent, equalling the ovary, 8–9mm long. *Flowers* to 5mm long; sepals green, petals whitish-green, lip yellow to white, column white; pedicel and ovary sessile, pubescent, 6–7mm long. *Sepals* subsimilar, ovate-lanceolate, sub-connivent, dorsal surface laxly pubescent, 4–6mm long. *Petals* subobliquely elliptic, shorter than the sepals, 3–5mm long. *Lip* saccate at base, with 2 stout teeth at point of insertion of column, c.9 × 3mm (at epichile, when spread); epichile with 2 oblong, recurved, divergent lobules. *Column* very short, with 2 vertical processes under the projecting, horizontal lobes of the rostellum; pollinia clavate. *Fruit* ellipsoid, narrow, c.5mm long.

Duars (Jaldacca River). 1660–2000m. Fl. October–February.

GENERAL DISTRIBUTION. NE India, China, Thailand, Myanmar, Laos and Malaysia.

ETYMOLOGY. From the Latin *affinis* (neighbouring, allied to).

NOTES. *Z. affinis* is closely related to *Z. flava* but the latter has a very bright orange-yellow lip. It has also been confused with *Z. gracilis* (Breda) Bl. Santapau & Kapadia (1962) reduced *Z. affinis* to synonymy under *Z. gracilis*, a position followed by some later authors. However, Seidenfaden (1978a) reviewed the position and concluded that the two species were distinct. *Z. gracilis* probably does not occur in our region.

2. **Z. flava** (Wall. ex Lindl.) Trimen, Syst. Cat. Fl. Pl.: 90 (1885). Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 7380A (holo. K-LINDL!, iso.K-W!).

Etaeria flava Lindl. in Wall. Cat.: 7380A/B (1832), nom. nud.

Monochilus flavus Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 487 (1840).

Plant 15–25cm tall. Stem with 2 or 3 sheaths at base and 3 or 4 leaves towards apex, 3–9cm tall. *Leaves* ovate to ovate-lanceolate, clustered at top of stem, with inflated hyaline sheaths, withering during flowering, 1.4–3.7 × 0.7–1.5cm; petiole expanded into a scarious sheath at base, c.1.5cm long. *Inflorescence* subdensely 10- to 17-flowered; peduncle longer than the stem, pubescent, sheathed, 8–16cm long; sheaths 2–3, distant, linear-lanceolate c.2cm long; rachis 4.5–7cm long; floral bracts lanceolate, acuminate, softly pubescent, 6–7mm long. *Flowers* 2–3mm long; sepals dull, grey to olive-green, petals and column white, lip dull pink with a bright yellow apex; pedicel and ovary sparsely villose, 3–4mm long. *Sepals* subsimilar, ovate-oblong, with a few lax hairs, 2–2.5 × 1–1.5mm; *dorsal sepal* concave; *lateral sepals* smaller than the dorsal sepal, 1-veined. *Petals* narrowly oblong-elliptic, c.2mm long. *Lip* exceeding the sepals, boat-shaped at the base, with 2 oblong calluses enclosed in its folds, 3–3.5 × 3.8–4.3mm (across epichile when spread); epichile with 2 subquadrate, oblique, diverging, terminal lobes. *Column* short, stout, apex curving forwards, c.1.5mm long; anther horizontal; rostellum long; pollinia clavate; stigmas 2, small. *Fruit* swollen, ridged, narrowly ellipsoid, 5–7 × 2.5–3.5mm. **Fig. 28.**

Bhutan: C – Punakha (Bhotokha, near Khosa, Mishichen, Punakha to Tinlegang, Rimchu) and Mongar (Kuru Chu) districts; **Darjeeling** (Mongpu); **Sikkim** (between Dentam and Pemayangtse). On dry, open mountainsides; 900–1600m. Fl. March–May; Fr. May.

GENERAL DISTRIBUTION. India (Himalayas), Nepal, Myanmar and Thailand.

ETYMOLOGY. From the Latin *flavus* (yellow) in reference to the lip colour.

3. **Z. glandulosa** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 288, t.384 (1898). Type: India, Duars, *Pantling* 434 (holo. CAL!).

Heterozeuxine glandulosa (King & Pantling) Hashimoto, Proc. 14th World Orchid Conf.: 125 (1993).

Plant 15–23cm tall. *Stem* bearing a few, lax, hyaline sheaths. *Leaves* oblong-lanceolate, acute, shortly petiolate, blackish-purple, 2–5 × 0.5–1.8cm; petiole expanded into a wide hyaline sheath, c.2cm long. *Inflorescence* laxly few-flowered; peduncle short, pubescent, bearing 2 lanceolate, glabrous sheaths; rachis densely glandular-pubescent, 2.5–3.5cm long; floral bracts broadly ovate, bluntly acuminate, shorter than the ovary, 0.8–1cm long. *Flowers* up to 4mm across, olive-green, column and central contracted part of lip white; pedicel and ovary glandular-pubescent, 7–9mm long. *Sepals* subsimilar, connivent, ovate, acute, subequal, sparsely glandular-pubescent, c.5mm long; *dorsal sepal* concave. *Petals* asymmetrically suborbicular, suboblique, apiculate, c.5mm long. *Lip* equalling the sepals, widely saccate at the base, with a row of 3 lamellar calluses on each side and an incurved conical tooth on each margin within, c.5mm long. *Column* with very large lamellate wings at base, porrect, incurved; rostellum projecting, broad; pollinia pyriform, bifid, grooved; stigmas 2, small, linear-oblong.

Bhutan: S – Sarbhang district (Singi Khola); **Duars** (Jaldacca River). In dense subtropical jungle; 260–660m. Fl. March.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Latin *glandulosus* (gland bearing) in reference to the inflorescence.

NOTE. The shape of the column wings and the blackish-purple leaves differentiate this species from the closely related Z. *nervosa*.

4. **Z. goodyeroides** Lindl., Gen. Sp. Orchid. Pl.: 486 (1840). Type: India, Assam, *Griffith* 7 (holo. K-LINDL!, iso. K!).

Monochilus goodyeroides (Lindl.) Lindl. in J. Proc. Linn. Soc., Bot. 1: 187 (1857).

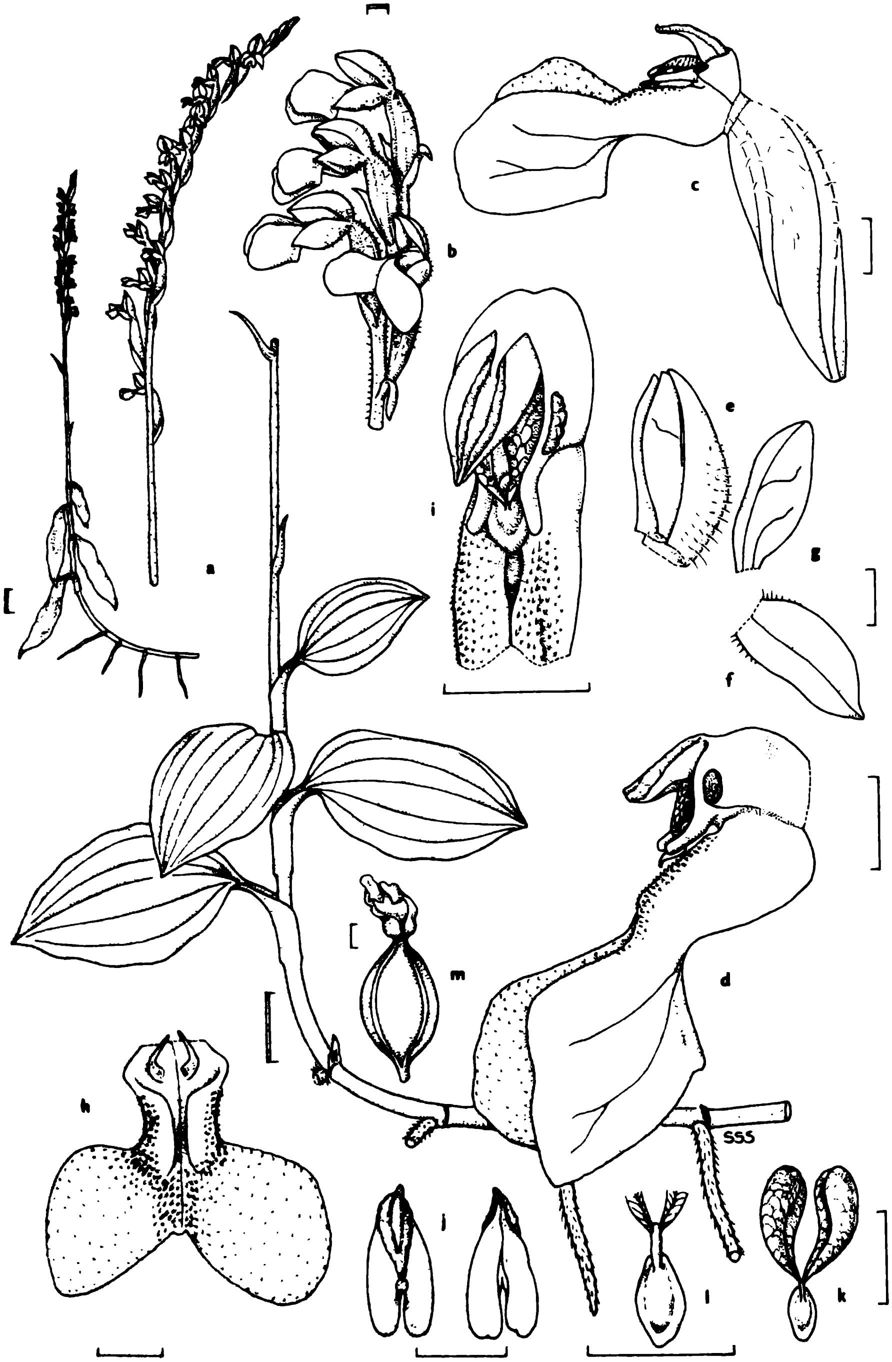


Fig. 23. ***Zeuxine flava***: a, habits; b, inflorescence; c, lip, column and ovary; d, lip and column (detail); e, dorsal **sepal with petals**. f, **lateral sepal**; **g**, **petal**; h, lip; i, column; j, anther (two views); k, pollinarium; l, viscidium and **stipe (detail)**; m, fruit. Drawn by Susanna Stuart-Smith, a–b from *Ludlow et al.* 20163 (K); c–l from *Kanai et al.* 13903 (K), m from *Dickason* 8448 (K).

Plant 10–22cm tall. *Stem* 5–12cm tall; sheaths clasping, distant, 0.5–1.2cm. *Leaves* 2–4, oblong-ovate, acute, shortly petiolate, velvety green with a pure white midrib, 2.2–3 × 1–1.8cm; petiole expanded into a basal sheath, 1–1.5cm long. *Inflorescence* laxly 3- to 15-flowered; peduncle ridged, sparsely pubescent, 8–14cm long, with 1 or 2 linear-lanceolate sheaths; rachis 2.5–7cm long; floral bracts ovate, acuminate, equalling the ovary, 0.7–1 × 0.25–0.3cm (at base). *Flowers* up to 5mm long, pink-white, lateral sepals green; pedicel and ovary sessile, 5–9mm long. *Sepals* subsimilar; *dorsal sepal* ovate, acute, 3.5–5mm long; *lateral sepals* narrowly lanceolate, spreading, 3–5 × 1–1.5mm. *Petals* falcate, subacute, connivent, 4–5mm long. *Lip* basally saccate, bidentate within, 3.5–4mm long; apex small, with incurved margins. *Column* short, broad, margins winged below; anther beaked; pollinia clavate; stigmas oval, lateral. *Fruit* erect, 0.7–1 × 0.3–0.4cm.

Bhutan: C – Timphu/Punkha district (Dochu La); **N** – Upper Kuru Chu district (Pang La); **Darjeeling** (Mahaldiram, Observatory Hill (F.E.H.2)); **Sikkim** (Bakhim, Rinchingpong, Tendong, Yoksam). In deep forest, on bank in partly cleared *Tsuga* forest; 1800–3080m. Fl. July–October.

GENERAL DISTRIBUTION. NE India, Myanmar and China.

ETYMOLOGY. From the related genus *Goodyera* which is similar vegetatively.

5. **Z. membranacea** Lindl., Gen. Sp. Orchid. Pl.: 486 (1840). Type: Bhutan, without precise locality, *Griffith* 16 (holo. K-LINDL!, iso. K!).

Plant up to 35cm tall. *Leaves* linear, apiculate, distant along the stem, reticulate, sheathing at base, 4–6 × 0.2–0.6cm. *Inflorescence* densely many-flowered, cylindric; rachis 2.5–6cm long; floral bracts lanceolate, acuminate, margins fringed, 3-veined, 5–7mm long. *Flowers* c.4mm long, white; ovary papillose or pubescent, 5–6mm long. *Dorsal sepal* oblong-lanceolate, acute, c.6 × 3mm; *lateral sepals* oblong, obtuse. *Petals* not adnate to the dorsal sepal, c.4mm long. *Lip* membranous, saccate at base, connate to the column base, c.4mm long; epichile elliptic-ovate, divided into 2 spreading wings. *Column* c.2.6mm long.

Bhutan: (unlocalised Griffith specimen); **Terai** (Dungdungia?); **Darjeeling** (Siliguri). 150–180m. Fl. November–January.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Latin *membranaceus* (thin and semi-transparent) in reference to the texture of the lip.

NOTES. Seidenfaden (1978a) included Z. *membranacea* within the synonymy of Z. *strateumatica*. We have examined the Himalayan plants and consider them to be distinct. Z. *membranacea* differs in that the plant is generally taller, the petals are not adnate to the dorsal sepal, the shape and texture of the lip is distinct and the ovary is papillose or pubescent rather than glabrous.

6. **Z. nervosa** (Wall. ex Lindl.) Bentham ex C.B. Clarke in J. Linn. Soc., Bot. 25: 73 (1889). Types: Bangladesh, Darwani, coll. *Buchanan-Hamilton* Wall. Cat. 7381A (syn. K-LINDL!, isosyn. K-W! K!); Bangladesh, Sylhet, coll. F. *De Silva* Wall. Cat. 7381B (syn. K-W!).

Etaeria nervosa Wall. Cat.: 7381 (1832), nom. nud.

Monochilus nervosus Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 487 (1840).

Haplochilus nervosus (Wall. ex Lindl.) D. Dietrich, Syn. Pl. 5: 172 (1852).

Z. *hengchuanense* S.S. Ying, Col. Illust. Indig. Orch. Taiwan 1: 342, t.124 (1977). Type from Taiwan.

Heterozeuxine nervosa (Wall. ex Lindl.) Hashimoto in Ann. Tsukuba Bot. Gard. 5: 21 (1986).

Plant 15–22cm tall. *Stem* glabrous, bearing 1 or 2 wide, scarious sheaths at base, c.7–15cm tall. *Leaves* 4–7, towards top of the stem, obliquely ovate-lanceolate, acute, petiolate, suffused with silvery-grey or green with a broad grey band along midrib, 2–6.5 × 1.5–2.5cm; petiole expanded at the base into a broad, hyaline sheath, 1.5–2cm long. *Inflorescence* laxly 3- to 8-flowered; peduncle sparsely pubescent, 5–11cm long, bearing 2 lanceolate, acuminate sheaths; rachis 1–3.5cm long; floral bracts ovate, acute to acuminate, scarious, exceeding the ovary, pubescent, 0.7–1 × c.0.3cm (at base). *Flowers* small, ± open; sepals green, petals white, lobes of lip yellow; pedicel and ovary twisted, pubescent, 0.7–1cm long. *Sepals* subsimilar, ovate, obtuse; *dorsal sepal* concave, 4–5mm long; *lateral sepals* wide, spreading, 5–6mm long. *Petals* suborbicular, asymmetric, abruptly apiculate at one side, c.7mm long. *Lip* exceeding the sepals, c.7mm long; hypochile saccate, the sac with 3 small parallel calluses on each side near the base within; epichile divided into 2 subquadrate, spreading lobes. *Column* short; rostellum 2-lobed, broad at the apex; pollinia obovate, bifid; stigmas minute. *Fruit* suberect, c.5 × 3mm.

Bhutan: S – Gaylegphug district (Hatisar); **Terai** (unlocalised *Hooker* specimen); **Duars** (Kumai); **Sikkim** (Nanga). In forest clearings and hot valleys; 750–1200m. Fl. February–March.

GENERAL DISTRIBUTION. E Himalaya, China, Thailand, Taiwan and the Philippines.
ETYMOLOGY. From the Latin *nervosus* (having several ribs) in reference to the leaf markings.

7. **Z. pulchra** King & Pantling in J. Asiat. Soc. Bengal 65(2): 127 (1896). Type: India, Sikkim, Lachung Valley, *Pantling* 412 (holo. CAL, iso. K!).

Plant to 15–20cm tall. *Stem* glabrous. *Leaves* 3 or 4, crowded, ovate, subacute, coriaceous, petiolate, the upper surface blackish-purple, midrib white, c.2.5 × 1.5cm; petiole short, broad, sheathing towards base, 6–8mm long. *Inflorescence* 2- or 3-flowered; peduncle c.7.5cm long; sparsely pubescent, with 2 sheaths; rachis up to 2.5cm long; floral bracts lanceolate, membranous, sparsely pubescent, shorter than the pubescent ovaries. *Flowers* to 0.8–1cm long; sepals and petals pale brown, lip yellow at base with a white apex. *Sepals* similar, ovate-lanceolate, free, spreading, dorsally pubescent. *Petals* obliquely lanceolate, curved, spreading. *Lip* exceeding the sepals, hypochile boat-shaped, saccate, with 2 unequal pairs of teeth at the margin within; epichile deeply divided into 2 large, divergent, wedge-shaped, subquadrate lobes, margins erose. *Column* with 8 tooth-like, erect processes; stigma lobes anticous.

Sikkim (Kendong, Lachung Valley). 2100m. Fl. August.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *pulcher* (beautiful).
NOTES. *Z. pulchra* is very closely allied to *Z. goodyerioides* and in the original description King & Pantling commented that the species 'may prove to be a malformation'. It has distinct 8-dentate column-projections, conjoined band-like stigmas and a distinctly 2-lobed epichile. Unfortunately, the type material at Kew consists of a few leaves only and it is impossible to determine whether or not this is a valid species.

8. **Z. reflexa** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 291, t.388 (1898). Type: India, Darjeeling, Mongpu, *Pantling* 361 (holo. CAL, iso. BM! K!).

Plant 17–23cm tall. *Stem* succulent, c.5mm thick, bearing a few lax, hyaline sheaths. *Leaves* narrowly ovate, acute, shortly petiolate, withering at flowering, 2–3cm long; petiole expanded into a wide hyaline sheath. *Inflorescence* laxly or subdensely c.15-flowered; peduncle equalling the stem, with long, lax hairs and 1 or 2 short, lanceolate sheaths; floral bracts lanceolate, acuminate, pubescent, equalling the ovary, 6–8mm long. *Flowers* up to 5mm long; sepals green, petals white, lip yellow, sac white; pedicel and ovary sessile, c.6mm long. *Sepals* similar, ovate-lanceolate, concave, laxly pubescent externally, 4.5–5mm long. *Petals* lanceolate, obtuse, c.4mm long. *Lip* exceeding the sepals, saccate at base, with a single laminar callus on each side within, 6–7 × 2–2.5mm long; epichile with 2 diverging, oblong-quadrate lobules and a minute apiculus between them. *Column* short, horizontal, with obliquely oblong processes, ventral surface concave; pollinia clavate-oblong.

Bhutan: C – Punakha district (Bhotakha, Rimchu to Khosa); **Darjeeling** (Mongpu). 1050–1300m. Fl. April–May.

GENERAL DISTRIBUTION. Thailand.

ETYMOLOGY. From the Latin *reflexus* (bent abruptly back).

NOTE. *Z. reflexa* is closely related to *Z. affinis* but the column has horizontal rather than vertical processes and the epichile lobes are larger. The herbarium material at Kew is poor and it has not been possible to confirm these features.

9. **Z. strateumatica** (L.) Schltr. in Bot. Jahrb. Syst. 45: 394 (1911). Lectotype: Herb. Hermann 2: 35, no.319 (lecto. BM!), designated by Cribb in Cafferty & Jarvis in Taxon 48(1): 49 (1999).

Orchis strateumatica L., Sp. Pl.: 943 (1753).

Pterygodium sulcatum Roxb., Hort. Bengal 63 (1814), nom. nud.; Fl. Ind. ed. 1832, 3: 452 (1832). Type: India, Calcutta, [icon. of] '*Pterogodium sulcatum*' Roxburgh 1086 (holo. CAL, iso. K!).

Tripleura pallida Lindl., Gen. Sp. Orchid. Pl.: 452 (1840). Type: Bangladesh, Sylhet, coll. *F De Silva & W. Gomez* Wall. Cat. 7391B (holo. K-LINDL!, iso. K-W!).

Zeuxine bracteata Wight, Icon. Pl. Ind. Orient. 5: t.1724 (1851). Type: India, Syndibad, *Wight* s.n.(holo. K, not found).

Z. brevifolia Wight, op. cit. t.1725 (1851). Type: India, Karnataka, *Jerdon* s.n. (holo. K!).

Z. robusta Wight, op. cit. t. 1726 (1851). Type: India, Karnataka, *Wight* s.n. (holo. K!).

Z. tripleura Lindl. in J. Linn. Soc., Bot. 1: 186 (1857). Type: India, Sikkim, *Hooker & Thomson* 352 (holo. K-LINDL!).

Z. rupicola Fukuyama in Bot. Mag. (Tokyo) 49: 292 (1935). Type from Japan.

Z. strateumatica var. *rupicola* (Fukuyama) S.S. Ying, Col. Illust. Indig. Orch. Taiwan 1: 512 (1977).

Plant to 22cm tall; *rhizome* creeping, fleshy. *Stem* erect, leafy, pale brown. *Leaves* suberect to erect, conduplicate, grass-like, linear-tapering, acute, sheathing at base, pinkish-buff, 2–6.5 × 0.3–0.6cm. *Inflorescence* densely many-flowered in a cylindric spike; rachis 1.5–4.5cm long; floral bracts lanceolate, acuminate, papery, reddish-brown, 0.4–1.4cm long. *Flowers* c.6 × 3mm, white with a yellow lip; ovary glabrous, 6–7mm long. *Dorsal sepal* hooded, oblong-lanceolate, acute, 5–6mm × c.3mm; *lateral sepals* oblong, obtuse, 5–5.5 × 2–3mm. *Petals* adnate to the dorsal sepal, forming a hood, hyaline, obliquely ovate, acute, 5–6 × 3–4mm. *Lip* recurved, 3-lobed, c.4 × 3mm, papillose; hypochile saccate, connate to the column; mesochile oblong; epichile transversely oblong-reniform. *Column* papillose, c.2.6mm long. *Fruit* ovoid, twisted, sessile, 6–8 × 4–5mm.

Duars (unlocalised *Haines* and *Pantling* specimens); **Sikkim** (unlocalised *Hooker & Thomson* specimen). In hot valleys, in rice fields, on grassy banks beside rivers; 160–330m. Fl. January–February.

GENERAL DISTRIBUTION. Widespread in S and E Asia to New Guinea. Probably introduced in south-east N America, S Africa and S Arabia.

ETYMOLOGY. Probably from the Greek *strateuma* (an army) in reference to the fanciful resemblance of a number of these plants growing together to an army.

NOTES. *Z. strateumatica* is closely related to *Z. membranacea* but differs in having a glabrous ovary and is a generally smaller plant. An extended synonymy can be found in Garay & Sweet (1974).

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

Z. lindleyana A.N. Rao in Arunachal Forest News 6(1): 34 (1988). Type: India, Arunachal Pradesh, W Kameng district, Tipi, *A.N. Rao* 6496 (holo. Orchid Herbarium Tipi).

NOTES. This species, of which we have seen no material, was described from the Kameng district of Arunachal Pradesh. It is related to *Z. strateumatica* but has an ovate-lanceolate lip mid-lobe with undulate margins, which suggests that it might be a peloric form of that species. *Z. strateumatica* is apomictic (Vu & Vohra, 1974; Sun, 1997) and local populations can, therefore, maintain their distinctness. This makes taxa such as *Z. lindleyana* and *Z. rupicola* (in syn. with *Z. strateumatica*) difficult to place.

Z. longilabris (Lindl.) Trimen, Syst. Cat. Fl. Pl. Ceylon: 90 (1885). Type: Sri Lanka (Ceylon), *Macrae* 4 (holo. K-LINDL!).

Monochilus longilabris Lindl., Gen. Sp. Orchid. Pl.: 487 (1840).

NOTE. Reported by Hegde & Rao (1987) from Dibru in the Kameng district of Arunachal Pradesh.

Subtribe **Spiranthinae** Lindl.

28. **Spiranthes** L.C. Richard

Plants terrestrial; *roots* fleshy, fasciculate. *Stem* short. *Leaves* conduplicate, fleshy, usually basal. *Inflorescence* terminal, densely flowered, racemose; rachis spirally twisted. *Flowers* small, subsessile. *Sepals* free; *dorsal sepal* erect, connivent with the petals to form a hood; *lateral sepals* oblique, spreading. *Lip* sessile or shortly clawed, entire or lobed, margins undulate, porrect, enveloping the column at base; lateral lobes parallel with the column. *Column* short, erect; clinandrium with prominent margins; rostellum bifid; anther erect, dorsal; pollinia 2, deeply cleft, mealy, attached to a terminal viscidium; stigmas 2; rostellum apical, elongate.

The genus *Spiranthes* was established in 1817 by the French botanist and explorer Louis Claude Richard in *De Orchideis Europaeis Annotationes*. Schlechter (1920) and Garay (1980) have revised the Spiranthinae and their generic revision is generally followed today. The genus comprises about 50 species distributed in temperate zones of N America and Eurasia, with a few subtropical species in the Old and New Worlds.

The spiral inflorescence of *Spiranthes* appears to be an adaptation to pollination by bees and bumble-bees. Bumble-bees always work upwards when foraging on the raceme. It has been suggested that this behaviour may be related to the protandrous state or may reduce the chance of revisiting a newly-emptied flower (van der Cingel, 1995). Catling (1983) reported that S. *lucida* Ames, from N America, is pollinated by halictid bees, while Larson & Larson (1987) reported species of *Bombus*, *Psithyrus* and *Apis* visiting S. *romanzoffiana* Chamisso with a high revisitation rate suggesting that nectar production is either continuous or copious. This continual reward for *Spiranthes* foragers may ensure pollination of all flowers, increase outcrossing and ensure pollination under suboptimal conditions.

LECTOTYPE. *Spiranthes spiralis* (L.) K. Koch; basionym: *Ophrys spiralis* L., *typ.cons.*
ETYMOLOGY. From the Greek *spiralis* (twisted, coiled) *anthos* (flower) in reference to the spiral arrangement of the flowers in some species.

1. S. sinensis (Persoon) Ames, Orchidaceae 2: 53 (1908). Type: China, 'prope Cantonem Sinarum' *Loureiro* s.n. (holo. P-LOUR!).

Neottia spiralis δ Willdenow, Sp. Pl. ed.4(1): 74 (1805). Type from Russia.
N. *sinensis* Persoon, Syn. Pl. 2: 511 (1807).
Aristotelea spiralis Loureiro, Fl. Cochinch. 1(2): 522 (1790). Type from China cited above.
Neottia flexuosa J.E. Smith in Rees, Cyclop. 24: Neottia 9 (1813). Type: Nepal, Suembu, *Buchanan-Hamilton* s.n. (holo. LINN! Herb. no. 1389.3).
N. *parviflora* J.E. Smith, *op. cit.* 10 (1813). Type: Nepal, Suembu, *Buchanan-Hamilton* s.n. (holo. LINN! Herb. no. 1389.4.1).
Spiranthes pudica Lindl., Coll. Bot.: t.30 (1821). Type: China, *Fortune* s.n. (holo. K-LINDL!).
S. *longispicata* A. Richard in Ann. Sci. Nat. (Paris) sér.2, 15: 78 (1841). Type: India, Nilgiri Hills, *Perrottet* s.n. (holo. P).
S. *densa* A. Richard, *loc. cit.* (1841). Type: India, Nilgiri Hills, *Perrottet* s.n. (holo. P).
S. *indica* Steudel, Nomencl. Bot. ed.2: 625 (1841), *nomen*
S *stylites* Lindl. in J. Linn. Soc., Bot. 1: 178 (1857). Type: China, Che-Kiang, *Fortune* 210 (holo. K-LINDL!, iso. US!).

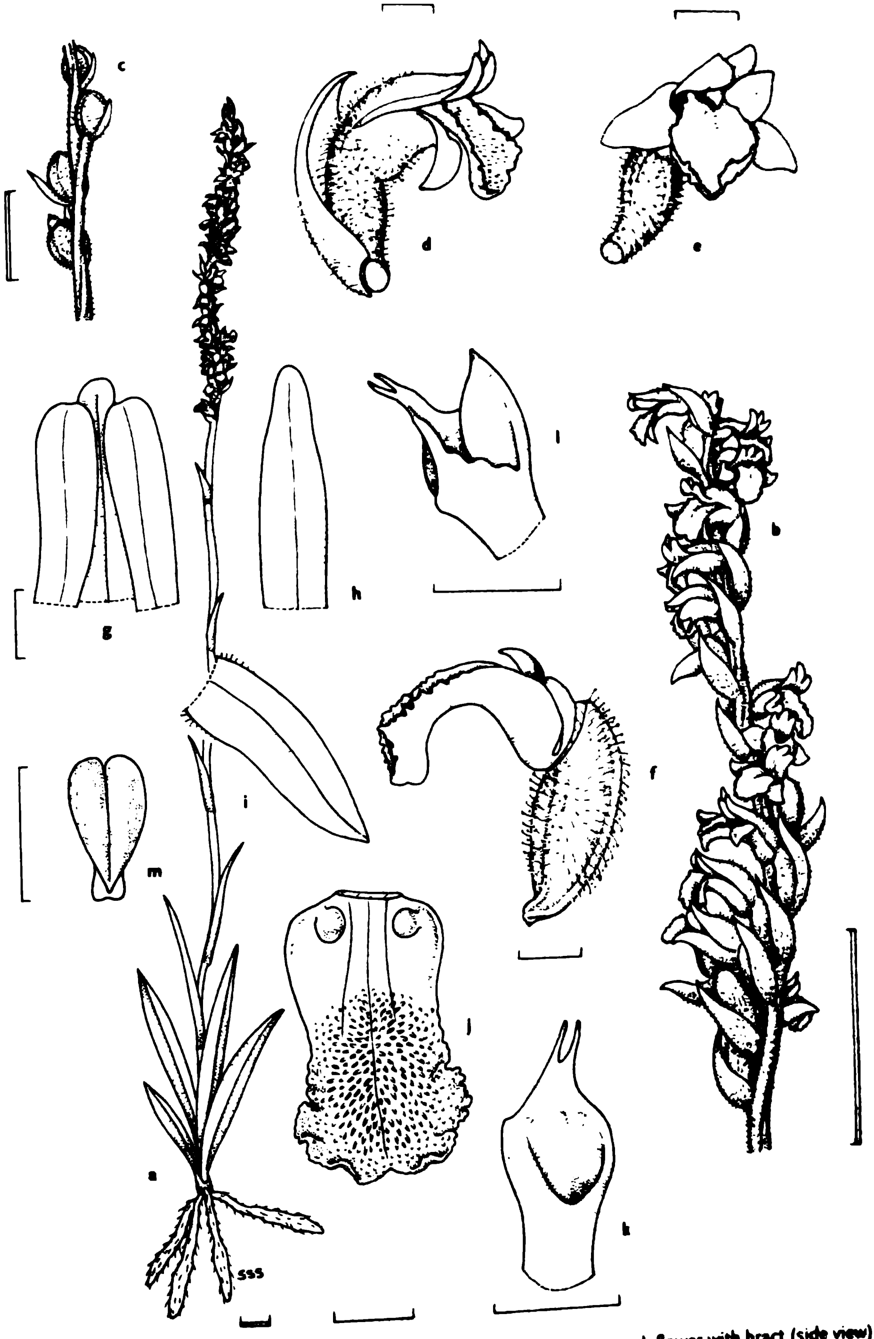


Fig. 29. **Spiranthes sinensis**: a, habit; b, inflorescence (detail); c, infructescence; d, flower with bract (side view); e, flower; f, lip, column and ovary; g, dorsal sepal and petals; h, dorsal sepal; i, lateral sepal; j, lip; k, column; l, column apex; m, pollinarium. Drawn by Susanna Stuart-Smith, a–b from *Pantling* 107 (K); c–m from *Grierson & Long* 3986 (K).

Plant 15–45cm tall; *roots* cylindric, hairy. *Leaves* 3–5, in a basal rosette, oblong-elliptic to linear-lanceolate, acute, glossy dark green, 5–16 × 0.4–1cm. *Inflorescence* densely many-flowered; peduncle glandular-hairy, bearing 2 or 3 distant sheaths; rachis spirally twisted; floral bracts lanceolate, acuminate, glandular-hairy, 4–8mm long. *Flowers* spreading, c.3mm long, pink with a white lip or white; pedicel and ovary glandular, 3–6mm long. *Sepals* subsimilar, glandular dorsally, 1-veined; *dorsal sepal* oblong-lanceolate, acute, 3.5–4.5 × 1–2mm; *lateral sepals* oblong-ovate, obtuse, 4–5 × 2–2.5mm. *Petals* oblong-ovate, obtuse, 1-veined, 3.4–5 × 1–2mm. *Lip* simple, concave, obovate, obtuse, 3.5–6 × 2–3mm; base with 2 large glands enclosed within; apical margin erose-undulate, surface subdensely glandular-setose. *Column* 2–3mm long, apex bifid. *Fruit* ovoid, glandular-pubescent, 6 × 3.5mm. **Fig. 29; Plate 5.**

Bhutan: S – Gaylegphug district (Sher Camp, Thewar Khola); C – Ha (Damthang, Sharithang), Thimphu (Begana, Dechencholing, Dotena, Drugye Dzong, Motithang, Paro Chu, Paro Dzong, Taktsang, Tashi Cho Dzong, Tsakimaphe), Tongsa (Longte Chu, Kinga Rapden, Shemgang), Bumthang (Dhur, Lami Gompa, Tang), Mongar (Kuru Chu) and Tashigang (Chorten Kora) districts; **N** –Upper Mo Chu district (Gasa); **Darjeeling** (Church Hill?, Rishap, Rongsong); **Sikkim** (Bitu, Gangtok, Tista River, Lachen Valley, Lachung, Pemayangtse, Yoksam). In damp, grassy clearings in juniper and rhododendron scrub, damp roadside banks, in subtropical forest, among boulders on open hillside; 300–2990m. Fl. March–October.

GENERAL DISTRIBUTION. E Russia, S and E Asia to the Malay Archipelago, Australia and the south-west Pacific Islands.

ETYMOLOGY. From the Latin *sinensis* (from China), the origin of the type specimen.

NOTES. A very variable species which may require splitting when its full range of variation has been examined. There is evidence that Australian plants referred to this species may warrant distinction at specific level (Clements, pers. comm.). The Bhutanese plants agree well with typical *S. sinensis*.

Garay & Sweet (1974) provided an extended synonymy for this species.

Subfamily **ORCHIDOIDEAE**

Tribe **Diurideae** Endlicher

Subtribe **Acianthinae** Schltr.

29. Corybas Salisbury

Plants lithophytic, terrestrial (rarely epiphytic), dwarf, arising from small tuberoids. *Stem* erect, short, slender. *Leaf* solitary, ovate-orbicular to cordate, borne horizontally above the ground, often veined with red or white. *Inflorescence* terminal, erect, 1-flowered. *Flower* sessile or shortly stalked, resupinate, helmet-shaped, large for plant, 1–2cm high. *Dorsal sepal* large, hooded; *lateral sepals* and *petals* linear or filiform. *Lip* large, recurved, entire, tubular below, with 2 short, basal spurs; base embracing the column; apex rounded, often fimbriate. *Column* small, erect; pollinia 2, 2-lobed, granular; stigma entire.

The genus *Corybas* was established in 1807 by the British botanist Richard Anthony Salisbury in his *Paradisus Londinensis*. However, for about a century, the genus was better known by Robert Brown's later name of *Corysanthes*. Van Royen (1983) has reviewed the species distributed to the east of the Wallace line, and Dransfield, Comber & Smith (1986) have reviewed the species to the west. The genus comprises about 100 species distributed from India, China, Taiwan and SE Asia to New Guinea, Australia, New Zealand and the SW Pacific.

A myophilous (fly pollination) syndrome has been reported by van der Pijl (1966) and Thomson (1927) has reported fungus-gnat (Culicidae) pollination in some New Zealand species.

TYPE. *Corybas aconitiflorus* Salisbury.

ETYMOLOGY. From Corybas, one of the priests of Cybele, later identified with the Curetes, who were young Cretan warriors referring, perhaps, to the shape of their helmets.

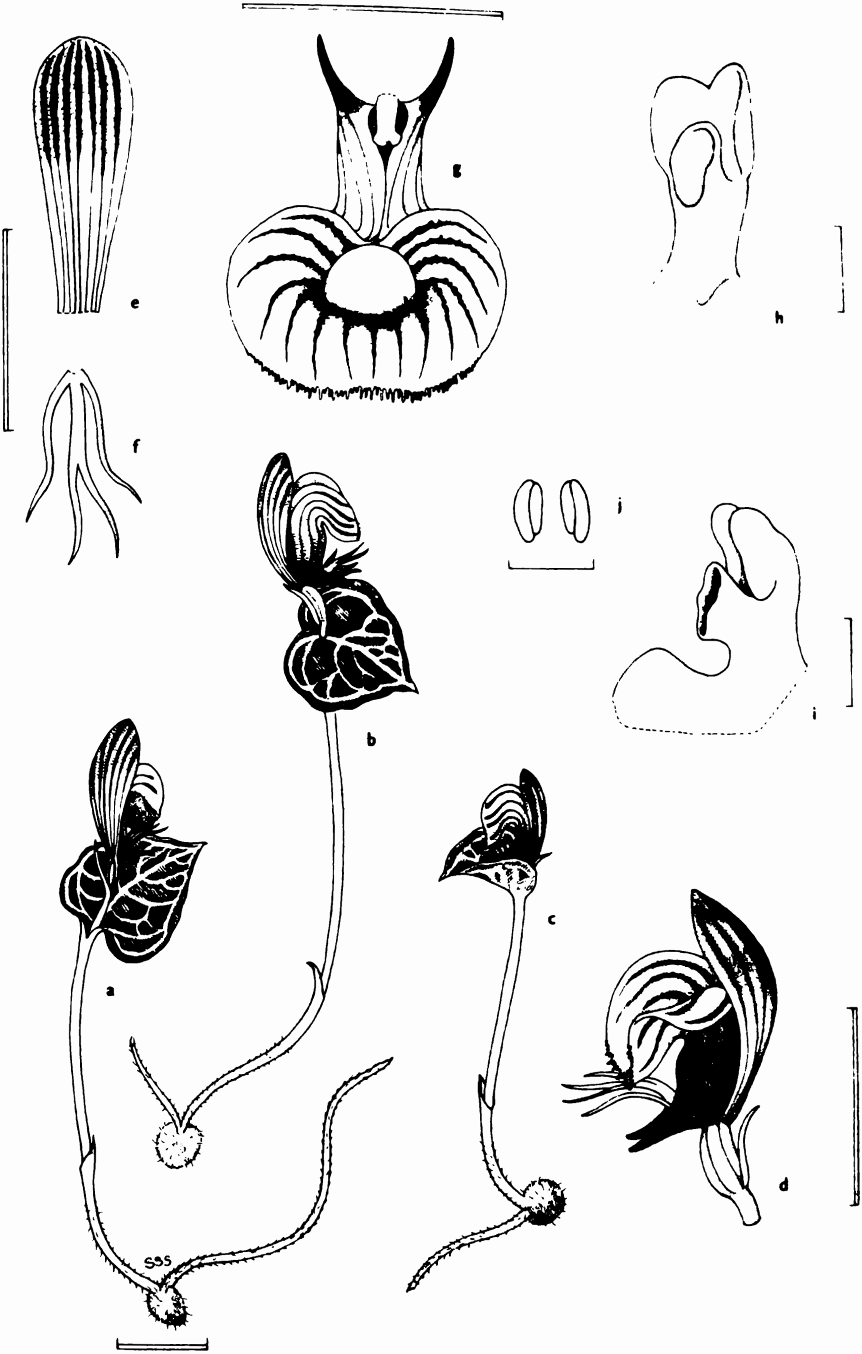


Fig 30. **Corybas himalaicus**: a–c, habits; d, flower; e, dorsal sepal; f, petals and lateral sepals; g, lip; h, column, i, column (side view); j, pollinia. Drawn by Susanna Stuart-Smith from *Kingdon-Ward* 8432 (K).

1. C. **himalaicus** (King & Pantling) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 19: 19 (1923). Types: India, Sikkim, Lachen valley, *Pantling* 385A (syn. AMES! BM! E! K! W!); India, Sikkim, Lamteng, *Pantling* 385B (syn. AMES! BM! CAL L! W!).

Corysanthes himalaica King & Pantling in J. Asiat. Soc. Bengal 65(2): 128 (1896).

Corybas purpureus Joseph & Yoganarasinham in J. Asiat. Soc. Bengal 55: 128 (1967). Type: India, Assam, Shillong, *Joseph* 36892A (holo. CAL).

Plant 5–7.5cm tall; *tuberoid* globose, depressed, hairy, 5–8mm in diameter. *Stem* glabrous, with a single convolute sheath near the base. *Leaf* inserted just beneath the flower, sessile, concave, cordate, acute to apiculate, green, with midrib and veins white, 0.6–1.2cm long. *Floral bract* linear-lanceolate, slightly longer than the ovary. *Flower* up to 1.5cm long, white; dorsal sepal transparent with rich, dark purple markings; pedicel and ovary thick, sessile, to 8mm long. *Dorsal sepal* oblanceolate, obtuse, concave, arching over the column and base of the lip, 1.3–1.4 × 0.4–0.5; *lateral sepals* short, filiform, bifurcate, positioned between the two spurs of the lip, 8–9 × 0.6–0.8mm. *Petals* short, filiform, acuminate, adnate to lateral sepals at base, 7–8 × 0.3–0.5mm. Lip oblong, deflexed from the middle; base convolute with 2 short, cylindric spurs; apex with unequally denticulate margins, obtuse, 1–1.2 × 1–1.2cm; *spurs* 2.5–3.5mm long. *Column* stout, 2–3mm long; stigma orbicular; anther erect. **Fig. 30.**

Bhutan: C – Bumthang district (near Bumthang, NW of Dhur); **N** – Upper Kulong Chu district (Lao); **Sikkim** (Lachen Valley). On moist vertical rocks, on moss on a fallen tree in *Tsuga dumosa* forest; 2600–3040m. Fl. June–July.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Himalayas.

30. Pantlingia Prain

Plant delicate, small, terrestrial. *Stem* erect, with a single leaf. *Leaf* inserted halfway up the stem, cordate, sessile, green. *Inflorescence* terminal, laxly few-flowered, racemose; floral bracts leafy. *Flowers* resupinate, green with a purple callus on the lip. *Sepals* and *petals* linear to oblong, acute to acuminate. Lip orbicular, slightly retuse, not embracing the column, spurless, callus basal, simple to complex, often with lateral processes. *Column* slender, curved, with a tooth-like process below; pollinia 2, granular.

The genus *Pantlingia* was established in 1896 by the British botanist David Prain (1857–1944) in the *Journal of the Asiatic Society of Bengal*. The genus comprises about 10 species distributed from the Himalayas to Japan and south to Java, Borneo, Sulawesi, New Guinea and New Caledonia.

In 1891 Makino described a plant from Shikoku in Japan as *Stigmatodactylus sikokianus* Maximowicz ex Makino but the publication lacked a description and was therefore invalid. This omission was corrected in 1905 when, in the *Botanical Magazine (Tokyo)*, he validly published the name. However, since these two genera are synonymous, the name *Pantlingia* has precedence.

TYPE. *Pantlingia paradoxa* Prain.

ETYMOLOGY. Named after Robert Pantling (1856–1910) the British botanist who collected the type specimen.

1. **P. paradoxa** Prain in J. Asiat. Soc. Bengal 65(2): 107 (1896). Type: India, Sikkim, Choongthang (Chunthang), *Pantling* 420 (holo. CAL, iso. AMES! BM! K! L!).

Stigmatodactylus paradoxus (Prain) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 10: 4 (1911).

S. sikokianus var. *paradoxus* (Prain) F. Maekawa, Wild Orchids of Japan: 187 (1971).

Plant 7–10cm tall; *rhizome* short, pubescent. *Stem* pubescent near base, glabrous above. *Leaf* ovate, acute, c.5mm long. *Inflorescence* 2- or 3-flowered; floral bracts ovate, acute, to 1cm long. *Flowers* c.3mm long, pale yellow with a purple blotch on the lip; pedicel and ovary c.1cm long. *Dorsal sepal* linear-

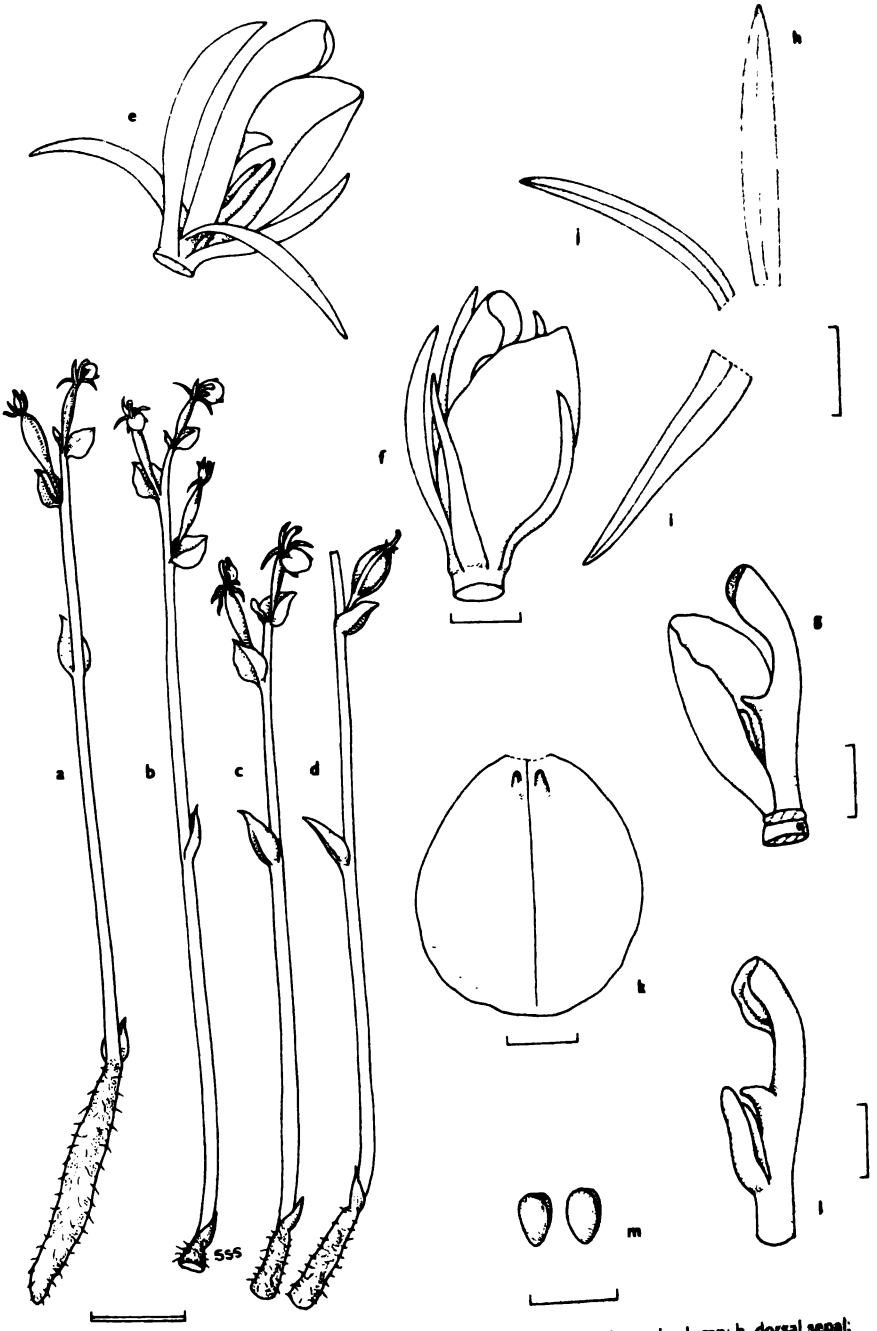


Fig. 31. **Pantlingia paradoxa**: a–d, habits; e, flower; f, flower (from below); g, lip and column; h, dorsal sepal; i, lateral sepal; j, petal; k, lip; l, column; m, pollinia. Drawn by Susanna Stuart-Smith from *Pantling* 420 (K).

oblong, appressed to the column, 1-veined, 3.2 × 0.4mm; *lateral sepals* linear, lying under and appressed to the lip, 1-veined, 2.9 × 0.5mm. *Petals* linear, reflexed to spreading, 1-veined, 2.8 × 0.3mm. *Lip* sessile, transversely elliptic, entire, slightly concave, margins incurved, 2.8 × 2.6mm; the upper surface with 2 elongate, parallel calluses. *Column* curved, with a rounded auricle on each side of the anther, 3–4mm long; ventral surface with a short, transverse, subtruncate plate in the middle and a 2-lobed, fleshy, tongue-like process at the base; pollinia in 2 pairs. *Fruit* ovoid, 5–8mm long. **Fig. 31.**

Sikkim (Chunthang). 2000m. Fl. September.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *paradoxus* (strange, unusual) in reference to the appearance of the plant.

Tribe **Orchideae**

We follow Pridgeon, Cribb, Chase & Rasmussen (in press) in our treatment of this tribe.

31. **Androcorys** Schltr.

Plants terrestrial, small; *tuber* globose, pubescent. *Stem* erect, ebracteate. *Leaf* single, erect, spathulate. *Inflorescence* terminal, racemose, laxly flowered. *Flowers* minute; ovary sessile, twisted. *Dorsal sepal* erect, ovate, concave; *lateral sepals* free to subconnate, spreading. *Petals* spreading, broadly axe-shaped, concave, adnate with dorsal sepal to form a hood over the column. Lip small, simple, spurless, oblong, apex narrowed, subobtuse, adnate to base of the lateral sepals, ecallose. *Column* short; anther locules hooded; pollinia clavate; caudicles short; viscidia separated by a hamulus-like appendage; rostellum triangular, erect; stigmas 2, convex, gibbose; staminodes 2.

The genus *Androcorys* was described in 1919 by Rudolf Schlechter in the *Repertorium Specierum Novarum Regni Vegetabilis Beihefte (Orchideologiae Sino-Japonicae Prodromus)*. The genus comprises six species distributed in the Indian Himalayas, Nepal, Bhutan, China and Japan.

Androcorys is related to *Herminium* but the flower has a simple lip and is spurless. The relationship between these genera requires further investigation. Lang (1996) revised the Chinese species.

TYPE. *Androcorys ophioglossoides* Schltr.
ETYMOLOGY. From the Greek *andrus* (anther) and *corys* (helmet, hood) in reference to the hood formed by the dorsal sepal and petals of the type species.

Key to species

1. Lip simple, oblong-triangular; lip base lacking pits; leaf less than 1.5cm long ... **1. A. gracilis**
+ Lip broadly 3-lobed; lip base with 2 deep pits; leaf more than 3cm long .. **2. A. pugioniformis**

1. A. gracilis (King & Pantling) Schltr. in Notizbl. Königl. Bot. Gart. Berlin 7: 397 (1920). Types: China (Xizang), Chumbi Valley, *Pantling* 374A (syn. CAL, isosyn. K!); India, Sikkim, Singalila, *Pantling* 374B (syn. CAL, isosyn. K!).
Herminium gracile King & Pantling in J. Asiat. Soc. Bengal 65(2): 131 (1896).

Plant 5–14cm tall; *tuber* globose-ovoid, 4–6 × 3–5mm. Stem slender, angled, sheathed at base, leaf borne towards base, 3.5–11cm tall; basal sheaths tubular, acute, overlapping, 0.8–1cm long. *Leaf* ovate, obovate or elliptic, obtuse, shortly petiolate and sheathing at base, strongly veined, 0.7–1.2 × 0.4–0.8cm; leaf sheath 0.8–1cm long. *Inflorescence* laxly 3- to 10-flowered; rachis glabrous, 0.7–4cm long; floral bracts lanceolate to oblanceolate, apex truncate, 3-lobed, outer lobes rounded, central lobe triangular, acute, 2–4 × 1–1.5mm. *Flowers* 1.5–2mm across; pedicel and ovary swollen, oblong, 2–3mm long. *Dorsal sepal* broadly ovate, obtuse, concave, hooded with petals, 1–1.5 × 0.5–1mm; *lateral sepals* oblong, obtuse, deflexed, concave at apex, 1–1.5 × 0.3–0.4mm. *Petals* oblong-elliptic, obtuse, concave,

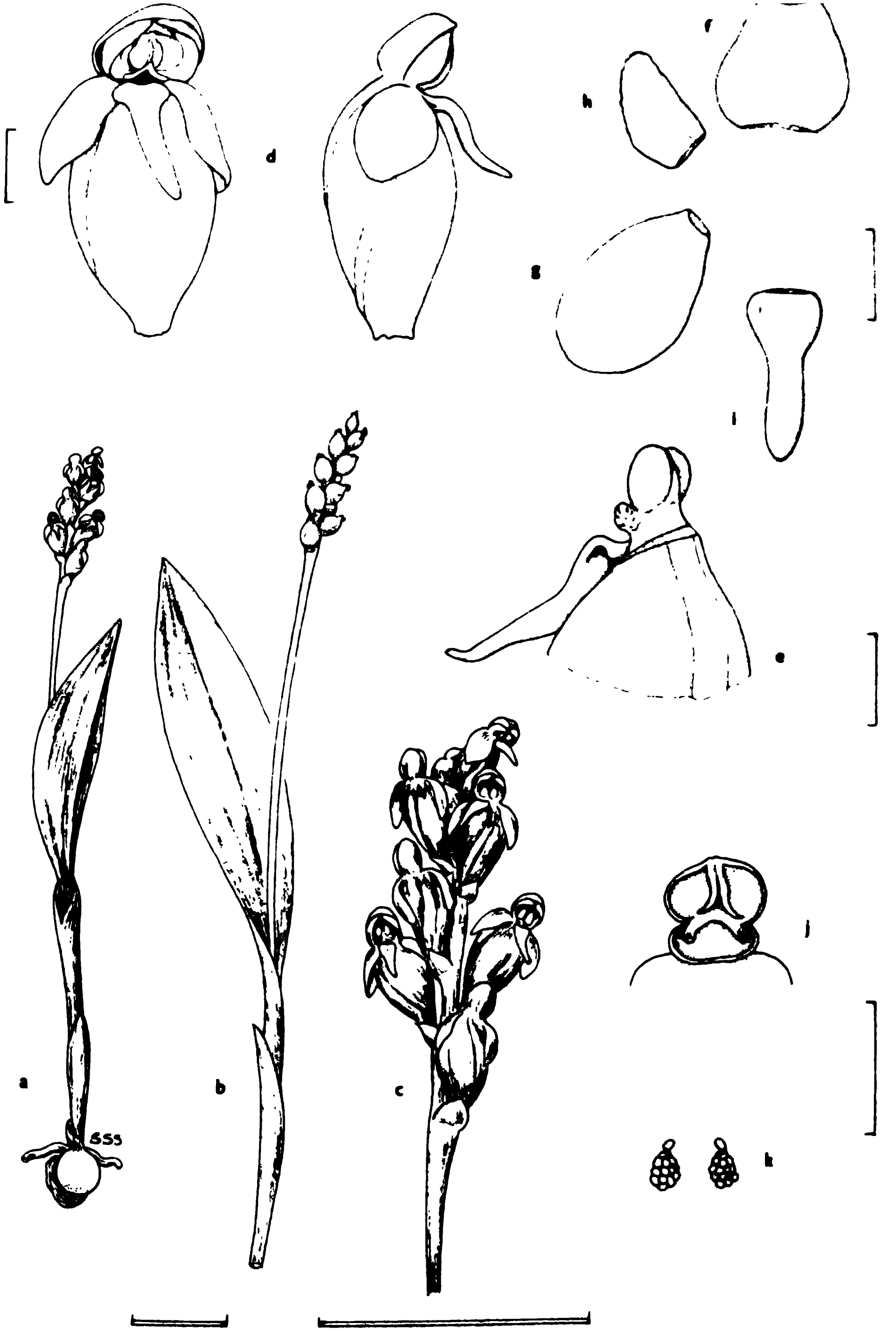


Fig. 32. **Androcorys pugioniformis**: a, habit (flowering); b, habit (fruiting); c, inflorescence; d, flower and ovary (front and side views); e, lip, column and ovary (side view); f, dorsal sepal; g, lateral sepal; h, petal; i, lip; j, column (front view); k, pollinia. Drawn by Susanna Stuart-Smith, a–k from *Dickoré* 3753 (K); l from *Stewart* 192 (K).

0.8–1.5 × 0.3–0.4mm. *Lip* simple, oblong-triangular, subacute, deflexed centrally, 0.6–1 × 0.3–0.5mm. *Column* hooded, small, 0.3–0.5mm tall; rostellum broad; anther locules widely spaced; stigmas medial to anther locules; pollinia broadly ovoid; caudicles bent at right-angles; viscidia small; staminodes small, oblong. *Fruit* erect, ovoid, 3–4 × 1.2–1.5mm.

Bhutan: C – Thimphu district (valley above Chenkaphug); **N** – Upper Mo Chu district (Lemcheng); **Darjeeling** (Sandakphu); **Sikkim** (Lachen, Singalila Range); **Chumbi** (unlocalised *Pantling* specimen). Shady mossy banks in *Abies*/*Juniperus*/*Rhododendron* forest; 3350–4200m. Fl. July.

GENERAL DISTRIBUTION. NE India and China.

ETYMOLOGY. From the Latin *gracilis* (slender) in reference to the stem of this species.

2. **A. pugioniformis** (Lindl. ex Hook. f.) K.Y. Lang in Guihaia 16(2): 105 (1996). Types: Alpine Himalaya, Kashmir, Kilan Marg, *Aitchinson* 106 (syn. K!) ; India, Garhwal, *Duthie* 517 (syn. K!) ; India, Sikkim, *Hooker* s.n. (syn. K-LINDL!, isosyn. K!).

Herminium pugioniforme Lindl. ex Hook. f., Fl. Brit. India 6(1): 130 (1890).

H. nivale Schltr. in Acta Horti Gothob. 1: 134 (1929). Type: China, Szechuan (Sichuan), Dongrergo, *H. Smith* 3631 (holo. UPS).

Plant 5–14cm tall; *tuber* globose to ovoid, 4–8 × 3–6mm. *Stem* bearing sheaths at base, leaf in lower third, ebracteate and glabrous above, 3.5–10.5cm long; basal sheaths 2, overlapping, tubular, 0.5–4cm long. *Leaf* oblong-spathulate to oblong-oblanceolate, subacute to obtuse, narrowed and sheathing at base, 3.5–7.5 × 0.5–1.5cm. *Inflorescence* laxly 4- to 10-flowered; rachis 0.9–3cm long; floral bracts minute, broadly ovate, subtruncate, 0.5–0.7mm long. *Flowers* erect, 2.5–3mm across, uniformly geen; pedicel and ovary broadly obovoid, 2.5–3mm long. *Dorsal sepal* broadly ovate, obtuse, 1-veined, hooded with the petals, 1.1–1.2 × 0.6–1.2mm; *lateral sepals* falcately oblong, obtuse, 1-veined, 1.5–1.8 × 0.8–1.5mm. *Petals* oblong-ovate, concave, margins crenulate, 1-veined, 1–1.5 × 0.3–0.7mm. *Lip* broadly 3-lobed, 1.4–1.8 × 0.5–1mm (across base); base expanded, auriculate, orbicular, fleshy, with 2 deep parallel pits; mid-lobe oblong, subterete, obtuse. *Column* 0.8mm tall; anther locules discrete, converging at apex; pollinia elliptic, subclavate, tapering (lacking caudicles); viscidium elliptic; staminodes oblong; stigmas conjoined, 0.8–1mm across. *Fruit* ovoid, erect, subsessile, 3–4 × 1.5–1.8mm. **Fig. 32.**

Bhutan: **N** – Upper Mo Chu (NE of Gangla Karchung) and Upper Pho Chu (Thanza) districts; **Darjeeling** (Phalut, Sandakphu); **Sikkim** (Samdong); **Chumbi** (Chomo Lhari). In alpine meadows, on moors with *Kobresia pygmaea* and *Rhododendron nivale*; 3600–4970m. Fl. August–September; Fr. September.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, NE India and China (Xizang).

ETYMOLOGY. From the Latin *pugioniformis* (dagger-shaped) in reference to the lip.

NOTES. This species resembles *Porolabium biporosum* (Maximovicz) T. Tang & F.T. Wang from Mongolia and China. We have not seen the type material of that species (Mongolia, Tangut, *Przewalski* 1880 (LE)) but both species have pits or holes at the base of the lip. Tang & Wang (1940) considered them to be distinct because of the column structure. Further collections of both species, and study of the type material, are required to resolve this problem.

32. Aorchis Vermeulen

Plants terrestrial; rhizomatous, lacking tubers. *Stem* bearing basal sheaths, 1 (rarely 2) leaves, ebracteate above leaves; basal sheaths membranous. *Leaf* solitary, ovate, sheathing at base. *Inflorescence* terminal, racemose; rachis short; floral bracts leaf-like, long. *Ovary* twisted. *Sepals* and *petals* subsimilar, dorsal sepal and petals forming a hood. *Lip* simple, spurred, spotted. *Column* very short; pollinia 2, caudate; caudicle medium; viscidium single, surrounded by a bursicle; bursicle complete to incomplete; stigma with separated lateral lobes. *Fruit* cylindric.

The genus *Aorchis* was established in 1972 by P. Vermeulen in the *Jahresberichte des Naturwissenschaftlichen Vereins in Wuppertal*. The genus comprises two species occurring in SE Asia.

TYPE. *Aorchis spathulata* (Lindl.) Vermeulen; basionym: *Gymnadenia spathulata* Lindl.
ETYMOLOGY. From the Greek *a-* (not, without) and *orchis* (a tuber, testicle), a reference to the absence of a tuber, found in other related species.

1. **A. spathulata** (Lindl.) Vermeulen in Jahresber. Naturwiss. Vereins Wuppertal 25: 33 (1972). Type: India, Kedarkanta, *Royle* 55 (holo. K-LINDL!).
Gymnadenia spathulata Lindl., Gen. Sp. Orchid. Pl.: 280 (1835).
Orchis spathulata (Lindl.) Rchb. f. ex Bentham in J. Linn. Soc., Bot. 18: 355 (1881).
O. spathulata var. *foliosa* Finet in Rev. Gén. Bot. 13: 516 (1901). Types: China, Yunnan, *Delavay* 4445/4682/2408 (syn. P); Szechuan (Sichuan), *Soulié* 327/349 (syn. P) and *Mussot* 356 (syn. P).
O. diantha Schltr. in Act. Hort. Gothoburg 1: 131 (1924) Type: China, N Szechuan (Sichuan), Dongrergo, H. Smith 3706 (syn. BM! K!); Dongrergo, H. Smith 3808 (syn. GB!).
O. spathulata var. *wilsonii* Schltr., op. cit. 132 (1924). Type: China, Szechuan (Sichuan), *Wilson* 1773 (holo. B†).
Galeorchis reichenbachii Nevski in Komarov, Fl. URSS 4: 670 (1935), *nom. nov.*
G. spathulata (Lindl.) Soó in Acta Bot. Acad. Sci. Hung. 12: 351 (1966).
G. diantha (Schltr.) Soó, op. cit. 352 (1966).
G. spathulata var. *wilsonii* (Schltr.) Soó, loc. cit. (1966).
Galearis diantha (Schltr.) P.F. Hunt in Kew Bull. 26: 171 (1971).
G. spathulata (Lindl.) P.F. Hunt, op. cit. 172 (1971).
Ponerorchis diantha (Schltr.) Soó in Acta. Bot. Acad. Hung. 20(3–4): 352 (1974).

Plant 7–18cm tall; *rhizome* slender, branched, 1.4–1.5cm long. *Stem* glabrous, 6–13cm long; basal sheaths 2, tubular, overlapping, 1–2.5cm long. *Leaf* ovate to ovate-elliptic, subacute, 3–7 × 1.2–2.9cm; petiole channelled, base sheathing, 2–5cm long. *Inflorescence* densely 1- to 4-flowered; rachis short, glabrous, 0.5–1.6cm long; floral bracts lanceolate, acute, margins minutely glandular, 1.5–2.5 × 0.3–0.6cm. *Flowers* 0.7–1.2cm across; sepals and petals purple-pink, lip purple-pink, spotted with dark purple, base yellowish-green; pedicel and ovary slender, twisted, 0.9–1.5cm long. *Dorsal sepal* oblong-ovate, acute, 5-veined, 1 × 0.5cm; *lateral sepals* subspreading, oblong-ovate, oblique, subacute, 5-veined, 0.6–1 × 0.3–0.5cm. *Petals* oblong, obtuse, 3-veined, 7–9 × 3–3.5mm. *Lip* simple, broadly elliptic to ovate, rounded at apex, spurred, slightly narrowed at base, margins crenulate, minutely glandular, spotted, 6–8 × 2.5–7mm (when spread); *spur* thick, ± curved, obtuse, 3–3.5 × 1–1.2mm. *Column* 1–1.8mm tall; anther locules parallel, lacking tubes; pollinia clavate; caudicles medium; viscidium oblong; stigmas 2, lateral lobes divergent. **Fig. 33**.

Bhutan: C – Ha (Sele La), Thimphu (Barshong, Dotena, between Pajoding and the Lakes, hill E of Thimphu), Punakha (Ritang to Pele La), Tongsa (Longte Chu), Tongsa/Bumthang (Yuto La), Bumthang (Chakong) and Sakden (Mera) districts; **N** –Upper Pho Chu (Lunana), Upper Bumthang Chu (Chamka, Tolegang) and Upper Kulong Chu (Me La, Shingbe to Lao) districts; **Sikkim** (Dethang, Dzongri, Kupup, Lachen, Lachung, Lungthung, Mon Lapcha, Phune, Samdong, Singalila Range, W of Thanggu, Tsomgo, Yakche, Yumthang); **Chumbi** (Chubitang, Kaju Gompa, Yatung). On turf on open hillsides, damp rocks, in the open, damp, grazed meadow, among dwarf *Rhododendron/Abies*; 3050–4500m. Fl. June–July.

GENERAL DISTRIBUTION. NW India, Nepal, NE India and China.
ETYMOLOGY. From the Latin *spathulatus* (spoon-shaped) in reference to the lip.

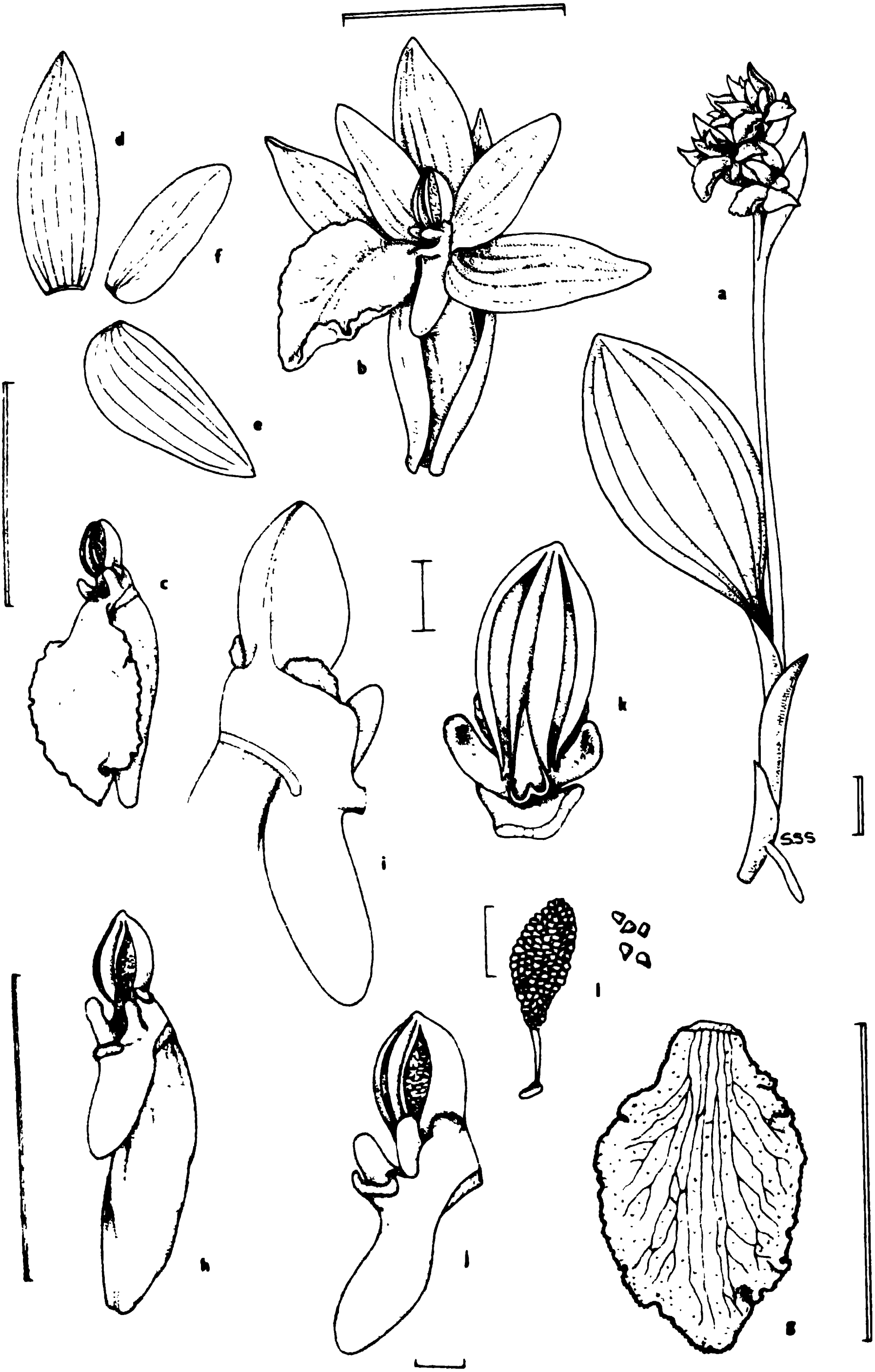


Fig 33 *Aorchis spathulata*: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column, spur and ovary (front view); i, column and spur (back view); j, column and spur; k, column (detail), l, pollinarium with massulae. Drawn by Susanna Stuart-Smith from *Gould* 4958 (K).

Doubtfully recorded species.

A. roborowskii (Maximowicz) Seidenfaden in Nordic J. Bot. 2: 9 (1982). Type: China, Tangut, Przewalski s.n. (holo. LE).
Orchis roborowskii Maximowicz in Bull. Acad. Imp. Sci. Saint-Pétersbourg sér.3, 31: 104 (1887).
O. stracheyi Hook. f., Fl. Brit. India 6(1): 128 (1890). Type: India, W Himalaya, Garhwal, near Rogle, *Strachey & Winterbottom* 35 (holo. K!).
Galeorchis roborowskii (Maximowicz) Nevski in Komarov, Fl. URSS 4: 670 (1935).
G. stracheyi (Hook. f.) Soó in Acta Bot. Acad. Sci. Hung. 12: 352 (1966).
Galearis stracheyi (Hook. f.) P.F. Hunt in Kew Bull. 26(1): 172 (1971).
Chusua roborowskii (Maximowicz) P.F. Hunt, op. cit.175 (1971).

NOTE. Hara, Stearn & Williams (1978) reported a distribution range from Garhwal to Bhutan, but we have been unable to locate any herbarium material to confirm records from the latter.

33. **Bhutanthera** Renz

Plants terrestrial, small; *tubers* globose-ovoid. *Leaves* 2, subopposite, ovate to lanceolate. *Inflorescence* terminal, racemose. *Sepals* and *petals* entire, similar. *Lip* 3-lobed, spurred at base; *spur* conical-cylindric. *Column* short; stigmas 2, conjoined, pulvinate; rostellar arms distinct; pollinia 2, clavate, mealy.

The genus *Bhutanthera* was established in 2001 by J. Renz in the *Edinburgh Journal of Botany*. The genus comprises five species distributed from the E Himalaya to SW China.

TYPE. *Bhutanthera albomarginata* (King & Pantling) Renz; basionym: *Habenaria albomarginata* King & Pantling.
ETYMOLOGY. A pun based on Bhutan, the centre of distribution of the genus, and the related genus *Platanthera*.

Key to species

1. Lip obscurely 3-lobed; lateral lobes reduced, much shorter than the mid-lobe ...... 4. **B. alpina**
+ Lip 3-lobed; lateral lobes equalling the mid-lobe 2

2. Inflorescence 1- or 2-flowered 3
+ Inflorescence more than 3-flowered 4

3. Sepals white; petals and lip red .... 2. **B. albosanguinea**
+ Sepals yellowish-green; petals yellowish-green to white; lip white .... 3. **B. albovirens**

4. Sepals green with white margins; flowers less than 5mm across; inflorescence more than 5-flowered .... 1. **B. albomarginata**
+ Sepals white; flowers more than 5mm across; inflorescence fewer than 5-flowered
5. **B. himalayana**

1. **B. albomarginata** (King & Pantling) Renz in Edinb. J. Bot. 58(1): 101 (2001). Type: India, Sikkim, Jongri (Dzongri), *Pantling* 450 (holo. K!, iso. BM! E! L! W!).
Habenaria albomarginata King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 322, t.425 (1898).
Platanthera albomarginata (King & Pantling) Kränzlin, Orchid. Gen. Sp. 1: 939 (1898).
Peristylus albomarginata (King & Pantling) M.L. Banerji & P. Pradhan, Orchid. Nepal Himalaya: 92 (1984).

Plant 9.5–14cm tall; *tuber* depressed-globose, 0.6–1.4 × 0.7–1.3cm. *Stem* stout, sheathed at base, glabrous, 6.5–11cm long; basal sheath tubular, wide-mouthed at apex, ovate, subacute, 2.5–3.5 × 0.6–0.7cm. *Leaves* 2, remote, unequal, orbicular-elliptic to oblong, obtuse, narrowed towards sheathing base, 3–5.2 × 1.3–2.4cm. *Inflorescence* subdensely 5- to 20-flowered; rachis glabrous, 1–3.5cm long;

lower floral bracts large, leaf-like, lanceolate, spreading, 1.8–2 × 0.3–0.4cm; upper bracts minute, triangular, 1–1.5mm long. *Flowers* 4–5mm across; sepals green with white margins, petals and lip white; ovary sessile, swollen towards base, 4–6mm long. *Dorsal sepal* broadly elliptic-ovate, obtuse, spreading, 4 × 2.5mm; *lateral sepals* elliptic-ovate, obtuse, spreading, 4.5 × 2mm. *Petals* suborbicular, concave, apex hooded, 2 × 1.5mm. *Lip* broadly oblong, deeply 3-lobed, 2 × 1.5mm (across lateral lobes); lateral lobes oblong, weakly falcate; mid-lobe oblong, narrowed to an obtuse apex; *spur* cylindric, depressed, straight, 2mm long. *Column* 1.5mm tall; pollinaria clavate-elliptic, 1–1.2mm long; rostellar processes prominent.

Sikkim (Dzongri, Nathang, Singalila Range, Tsomgo Chhu, Yampung). On yak-grazed slopes; 3720–4270m. Fl. July–September.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. From the Latin *albus* (white) and *marginatus* (having a distinct margin) in reference to the sepals.

2. B. albosanguinea Renz in Edinb. J. Bot. 58(1): 101 (2001). Type: Bhutan, Thimphu, Darkey Pang Tso, J.R.I. *Wood* 7405 (holo. E!).

Plant 4.5cm tall. *Stem* erect, glabrous, sheathed at base, 3cm tall; basal sheath tubular, apex unknown (specimen damaged), 1.1cm long. *Leaves* 2, towards apex of stem, lanceolate, acute, tapered gradually to a sheathing base, margins entire to weakly undulate, strongly veined, 2.3–2.5 × 0.4–0.8cm. *Inflorescence* 2-flowered; rachis 1cm long. *Flowers* 1–1.3cm across; sepals white, petals red, lip red; pedicel and ovary twisted, 7–9mm long. *Dorsal sepal* elliptic-obovate, rounded, margins glandular, 1-veined, 5 × 4mm; *lateral sepals* elliptic, subacute, margins glandular, 1-veined, 6 × 4mm. *Petals* spathulate, rounded, hooded at apex, margins entire, 5 × 2.2mm (at wide apex). *Lip* 3-lobed, narrowed and ± clawed at base, spurred, base 1 × 1mm; lateral lobes oblong, obtuse, 3 × 1mm; mid-lobe oblong, obtuse, 3 × 1mm; *spur* conical, 2mm long. *Column* 1.5–2 × 1.5mm; polliniaria 1.6mm long.

Bhutan: C – Thimphu district (near Darkey Pang Tso, N of Paro). In rock crevices, on cliffs; 4100m. Fl. August.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. From the Latin *albus* (white) and *sanguineus* (blood-red) in reference to the flower colour.

NOTE. The type specimen consists of a single, slightly damaged plant.

3. B. albovirens Renz in Edinb. J. Bot. 58(1): 102 (2001). Type: Bhutan, Thita Tso, Rinchen Chu, *Ludlow & Sherriff* 3441 (holo. BM!).

Plant 4–6cm tall; tuber globose, 0.5–1 × 0.4–0.5cm. *Stem* glabrous, base covered by leaf sheaths and bearing a basal bladeless sheath, 1.8–2.2cm long; sheath tubular, widening upwards, mouth wide, 1–1.6cm long. *Leaves* 2, subopposite, lanceolate to ovate-lanceolate, subacute, margin entire, glandular, narrowed at base, 1–1.9 × 0.4–1.1cm. *Inflorescence* 1- or 2-flowered; floral bracts lanceolate, acuminate, 3 × 0.5–1mm. *Flowers* 0.8–1cm across; sepals yellowish-green, petals yellowish-green to pure white, lip white; pedicel and ovary fusiform, 6–8mm long. *Dorsal sepal* ovate, obtuse, 1-veined, 5 × 3.5mm; *lateral sepals* obliquely ovate, falcate, subacute, 1-veined, 6–6.5 × 3–4mm. *Petals* obovate, rounded, 3-veined, 3–5 × 2.5–4mm. *Lip* deeply 3-lobed, spurred, base quadrate, 0.5 × 2mm; lateral lobes oblong, rounded, 3.5–4 × 0.8mm; mid-lobe oblong, rounded, 5 × 0.6mm; *spur* globose, curved forwards, 2–3 × 0.8–1mm. *Column* broad, 1mm tall; anther cap long-beaked, 1.5–1.9mm long. **Fig. 34.**

Bhutan: C – Tongsa district (Rinchen Chu, Thita Tso); N – Upper Mo Chu (near Gyengathang) and Upper Kulong Chu (Shingbe to Me La) districts. On moist rocks, wet grassy cliff-ledges, open dwarf rhododendron scrub; 4270–4720m. Fl. July–September.

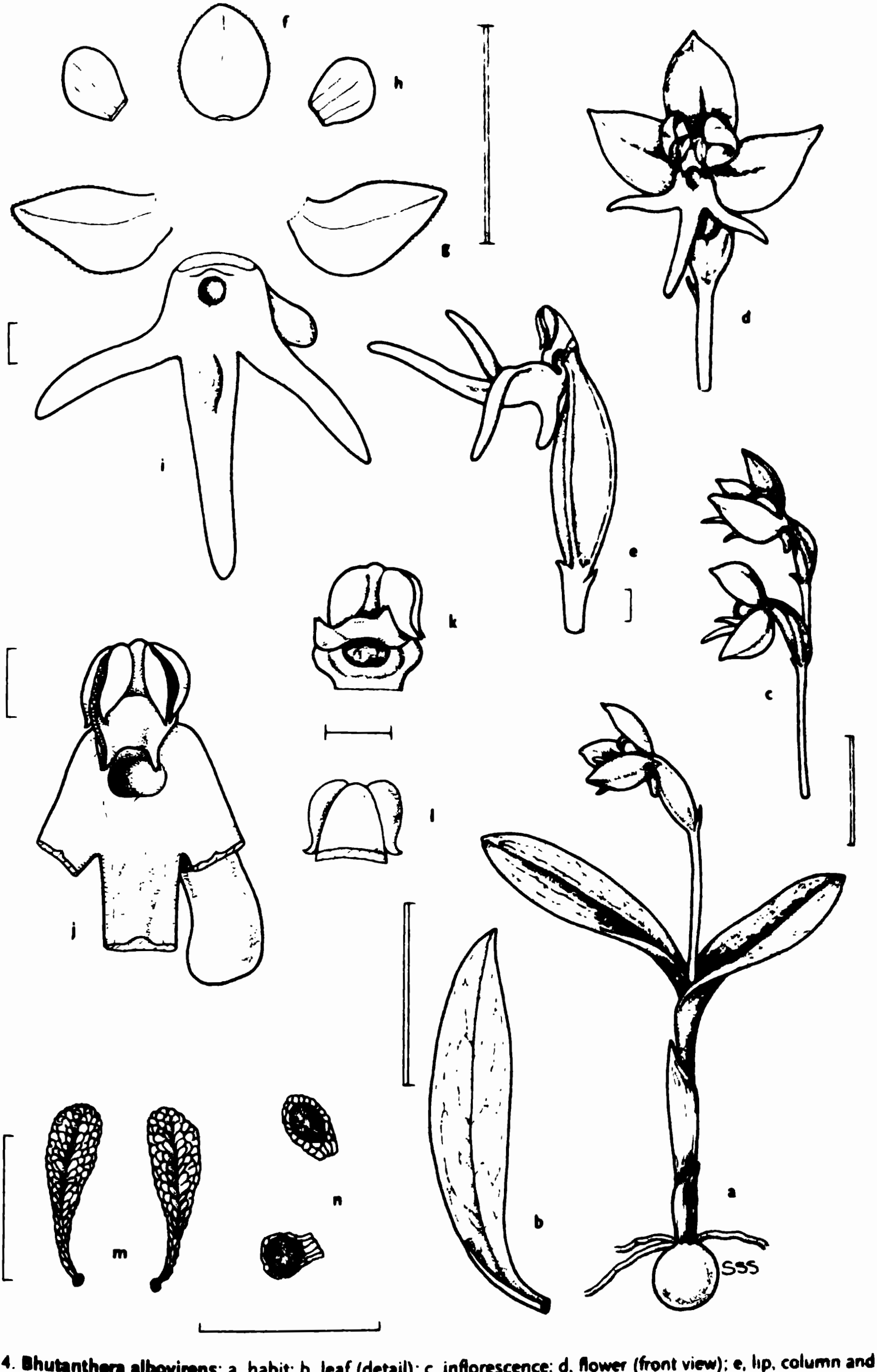


Fig. 34. **Bhutanthera albovirens**: a, habit; b, leaf (detail); c, inflorescence; d, flower (front view); e, lip, column and ovary (side view); f, dorsal sepal; g, lateral sepals; h, petals; i, lip; j, column (with upper part of lip); k, column (front view); l, column (back view); m, pollinaria; n, seeds. Drawn by Susanna Stuart-Smith from *Ludlow & Sherriff* 3441 (BM).

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *albus* (white) and *virens* (green) in reference to the flower colour.

4. **B. alpina** (Handel-Mazzetti) Renz in Edinb. J. Bot. 58(1): 102 (2001). Type: China, Yunnan, between Mekong and Salvin, Yigoru, *Handel-Mazzetti* 9716 (holo. WU, iso. AMES! E! LE! W!).
Habenaria alpina Handel-Mazzetti in Symb. Sin. Pl. 7: 1336 (1936).

Plant 4–7cm tall; tubers 2, globose, covered by a membranous sheath, 4–5 × 4–5mm. *Stem* base covered by leaf sheaths and bearing a basal bladeless sheath, ridged, glabrous, 2.8–5.1cm tall; sheath tubular, mouth wide, broadly lanceolate, acute, 0.9–1.4cm long. *Leaves* 2, subopposite, ovate-elliptic to ovate-lanceolate, obtuse to subacute, narrowed at base to channelled petiole extending into a sheath, margins glandular-fringed, 1.5–2.8 × 0.9–1.6cm. *Inflorescence* 3- to 6-flowered; rachis ridged, flattened, glabrous, 1–2cm long; floral bracts minute, triangular, obtuse to subacute, 0.6–1 × 0.4–0.6mm. *Flowers* 5–7mm across, uniformly white, bluish inside; pedicel and ovary fusiform, narrowed at base, 4–6mm long. *Dorsal sepal* erect, ovate, obtuse, 1-veined, 2–3.5 × 1.2–2.5mm; *lateral sepals* spreading, obliquely ovate, falcate, subacute, 1-veined, 3–4 × 2–2.3mm. *Petals* small, ovate, obtuse, hooded over column, 1.5 × 1mm. *Lip* 3-lobed, spurred; lateral lobes small, triangular-ovate to rounded, obtuse, 0.5–0.8 × 0.5–0.8mm; mid-lobe oblong, tapering to recurved, rounded apex, 2–2.8mm long; *spur* cylindric, 2.2–2.5 × 0.8–1mm. *Column* stout, 0.8 × 0.8mm; anther cap 1mm long.

Bhutan: N – Upper Mo Chu (Tsophu Chu) and Upper Kuru Chu (Narim Thang) districts; **Sikkim** (Bikbari to Chaunrikhiang, Choktsering Chhu Valley). In damp meadows and yak-grazed slopes, *Kobresia* pasture on S-facing slope; 4270–4300m. Fl. July.

GENERAL DISTRIBUTION. China (Yunnan).
ETYMOLOGY. From *alpinus* (alpine) in reference to the habitat.

5. **B. himalayana** Renz in Edinb. J. Bot. 58(1): 104 (2001). Type: Bhutan, Pangotang-Tsampa (Chamka), *Ludlow, Sherriff & Hicks* 19304 (holo. E!).

Plant 5–6.5cm tall; tuber ovoid to globose, 0.7–0.9 × 0.4–1cm. *Stem* erect, lower half covered by leaf sheaths and bearing a basal bladeless sheath, 2.5–4cm long; basal sheath tubular below, splitting to form a broadly lanceolate, acute to subacute apex, 1.3–1.9cm long. *Leaves* 2, subopposite, sheathing, lanceolate-elliptic, obtuse to subacute, finely reticulate, 1.7–2.2 × 0.4–0.9cm; sheaths tubular, overlapping, 1.5–2cm long. *Inflorescence* subsecund, laxly 3- or 4-flowered; rachis glabrous, 1–2cm long; floral bracts triangular-lanceolate, acute, 0.5–0.6 × 0.6–0.8mm. *Flowers* 0.7–0.9cm across, uniformly white, dorsal sepal with a green central vein; pedicel and ovary glabrous, twisted, 5–6mm long. *Dorsal sepal* ovate-elliptic, subacute, 1-veined, 5 × 3mm; *lateral sepals* ovate-lanceolate, obtuse to subacute, 1-veined, 6 × 2.8mm. *Petals* short, spathulate, obtuse, hooded at apex, 2.5 × 1.5mm. *Lip* 3-lobed, shortly clawed at base, spurred, base 1mm long; lateral lobes linear, widened slightly at base, acute, 2.5 × 0.6mm; mid-lobe linear to ligulate, obtuse, 4 × 0.8mm; *spur* cylindric-conical, obtuse, 1.5–2mm long. *Column* 1–1.5mm long; rostellar processes 0.25mm long; pollinaria 1.2mm long.

Bhutan: C – Thimphu district (Barshong); **N** – Upper Pho Chu (Kesha La), Upper Bumthang Chu (Chamka, Marlung, Pangotang) and Upper Kulong Chu (Shingbe to Me La) districts. Among dwarf rhododendrons on steep hillsides, on open grassy hillsides and cliff ledges; 3960–4570m. Fl. June–August.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Himalayas.

34. **Brachycorythis** Lindl.

Plants terrestrial (rarely epipyhtic or mycotrophic); *tuber* fusiform to ellipsoid. *Stem* leafy (rarely covered in scales). *Leaves* numerous, overlapping. *Inflorescence* terminal, racemose; floral bracts leaf-like. *Flowers*

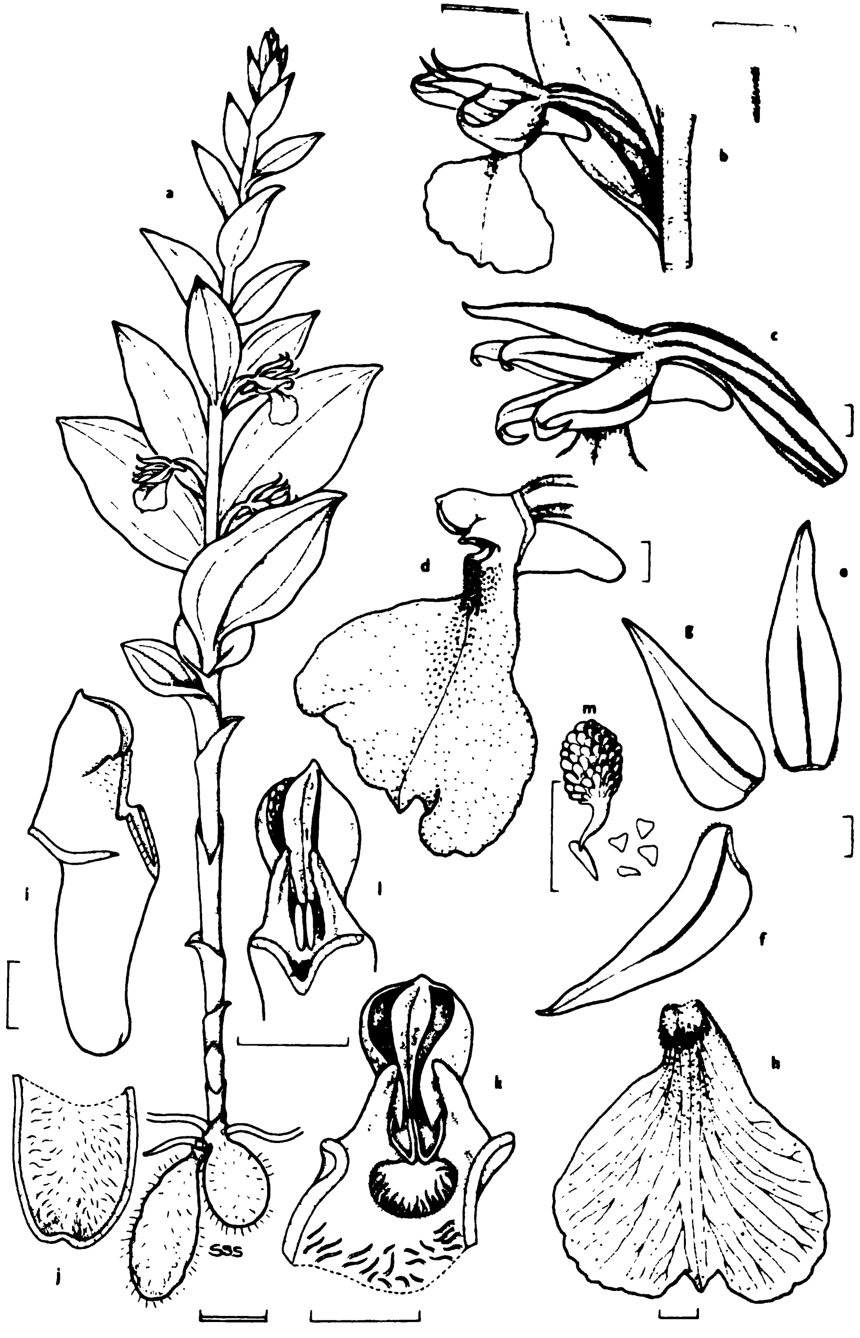


Fig. 35. **Brachycorythis obcordata**: a, habit; b, flower, ovary and bract (with detail of stem surface); c, flower and ovary (detail); d, lip, column and spur; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, spur and column (side view); j, section through spur (detail); k, column and lip base (detail); l, column; m, pollinarium (with massulae). Drawn by Susanna Stuart-Smith, a from *MacKinnon* 2755 (K); b–m from *Ludlow & Sherriff* 315 (K).

white, yellow, pink or purple, spotted. *Sepals* subsimilar, free, entire; *lateral sepals* spreading, oblique. *Petals* entire, adnate to column base. Lip bipartite, spurred; hypochile spurred, saccate, boat-shaped; epichile flattened, entire, 2-or 3-lobed; *spur* shorter than lip. Column erect, slender; anther locules parallel, lacking canals; pollinia 2, granular; caudicles short; viscidia 2, naked; stigma hollowed; rostellar mid-lobe small, erect, folded, lateral lobes fleshy, short.

The genus *Brachycorythis* was established in 1835 by John Lindley in his *Genera and Species of Orchidaceous Plants*. Summerhayes (1955) revised the genus which comprises about 35 species distributed in Africa, Madagascar and subtropical Asia east to Taiwan.

TYPE. *Brachycorythis ovata* Lindl.
ETYMOLOGY. From the Greek *brachy-* (short) and *corythis* (helmet) in reference to the helmet-like appearance of the dorsal sepal and petals.

1. **B. obcordata** (Lindl.) Summerhayes in Kew Bull. 10(2): 243 (1955). Types: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 7050A (syn. K-W!, isosyn. K!); India, Kamaon, coll. R. *Blinkworth* Wall. Cat. 7050B (syn. K-W!, isosyn. K!).
Platanthera obcordata Lindl., Gen. Sp. Orchid. Pl.: 290 (1835).
Orchis obcordata sensu Buchanan-Hamilton ex D. Don, Prodr. Fl. Nepal: 23 (1825), non Willemet.
Gymnadenia obcordata (Lindl.) Rchb. f., Otia Bot. Hamburg.: 32 (1878).
Habenaria galeandra sensu Hook. f., Fl. Brit. India 6(1): 163 (1890), non Bentham.
Habenaria obcordata (Lindl.) Fyson, Fl. Nilgiri & Pulney Hill-tops 1: 405 (1915).
Phyllomphax obcordata (Lindl.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 119 (1919), *in obs.*

Plant 5–24cm tall; *tuber* globose to cylindric, 1 × 0.5cm. *Stem* with bladeless sheaths at base, glandular-pubescent, 5.5–14cm long; basal sheaths 2 or 3, overlapping, tubular, 1–2cm long, mouth wide. *Leaves* many, distant along stem, oblong-lanceolate to elliptic-lanceolate, subacute to obtuse, sessile and sheathing at base, 2.5–5 × 1–1.8cm; sheath tubular, 1–1.5cm long. *Inflorescence* subdensely few- to many-flowered; rachis minutely glandular-pubescent, 3–9cm long; floral bracts oblong-ovate to lanceolate, becoming smaller up the rachis, 0.9–2.6 × 0.3–0.5cm. *Flowers* 0.7–1.2cm across, uniformly pink to pale purple; pedicel and ovary fusiform, curved, puberulous, 0.8–1cm long. *Dorsal sepal* erect, ovate-lanceolate, 1-veined, 4–6 × 1.5mm; *lateral sepals* ovate-lanceolate, acuminate, falcate, spreading, 1-veined, 5–7 × 1–1.5mm. *Petals* ovate-lanceolate, weakly falcate, hooded with the dorsal sepal, 1-veined, 4–5 × 1.8mm. *Lip* simple to obscurely 3-lobed, spurred, broadly triangular to broadly obcordate, mucronate, surface papillose, 7–9 × 6–7mm; *spur* short, conical, 3mm long, mouth wide. *Column* 1.5–2mm tall; staminodes distinct, curved. **Fig. 35.**

Bhutan: C – Punakha (Chusom, Punakha, Samtengang, Wangdi Phodrang) and Mongar (Khoma, Kuru Chu near Lhuntse, Lingitsi) districts; **N** – Upper Mo Chu district (Gasa, Tamji). On steep, well-drained slopes with sparse scrub, with *Pinus roxburghii*; 1200–2290m. Fl. July–September.

GENERAL DISTRIBUTION. NW India, Nepal, NE India.
ETYMOLOGY. From the Latin *obcordata* (reverse-cordate) in reference to the lip shape.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

B. iantha (Wight) Summerhayes in Kew Bull. : 238 (1955). Type: India, Neilgherries, *Wight* s.n. (holo. K-LINDL!).
Platanthera iantha Wight, Icon. Pl. Ind. Orient. 5: t.1692 (1852).

NOTE. **Reported** by Chowdhery (1998) from the Kameng district of Arunachal Pradesh. This species is closely related to *B. obcordata* and the report may be based on a misidentification.

35. Chusua Nevski

Plants terrestrial, small to medium; *tuber* globose to cylindric. *Leaves* usually basal. *Inflorescence* terminal, lax to subdensely racemose, few- to several-flowered; floral bracts lanceolate, glabrous. *Flowers* pink or purple (rarely yellow), spotted with a darker shade; pedicel and ovary subsessile, glabrous. *Dorsal sepal* entire, adnate to the petals to form a hood over the column; *lateral sepals* similar, spreading. *Petals* entire. Lip 3-lobed, ecallose, spurred; *spur* equalling ovary. *Column* short, erect; anther locules parallel; pollinia 2, sectile, clavate; viscidia 2, born in delicate bursicles; rostellum triangular; stigma concave.

The genus Chusua was established in 1935 by S.A. Nevski in V.L. Komarov's *Flora Unionis Rerumpublicarum Sovieticarum Socialisticarum*. Species from this genus have recently been treated in *Orchis* (Lang, 1999), *Ponerorchis* (Soó, 1966) or *Chusua* (Hunt, 1971). *Chusua* is distinguished from *Orchis* by the presence of a bursicle around the viscidia, but since this feature is difficult to see in herbarium material, examination of living material is required to be sure of correct generic placement. Recent molecular work carried out at Kew (unpublished) has shown that *Chusua* and *Ponerorchis* are indeed distinct genera and that Chinese and Himalayan species should be referred to *Chusua* while species found in Japan and Taiwan mostly belong in *Ponerorchis*. The genus comprises about eight species distributed in India, Bhutan and China.

TYPE. *Chusua pauciflora* (Lindl.) P.F. Hunt = *Chusua secunda* Nevski, *nom. superfl.*
ETYMOLOGY. Named from the specific epithet of *Orchis chusua* D. Don which derives from *choo-swa*, a Nepalese (Nawari) name recorded for this species.

Key to species

1. Lateral sepals reflexed (pointing backwards behind the dorsal sepal); 1-flowered . **1. C. chrysea**
+ Lateral sepals not reflexed; 2- or more-flowered 2

2. Lip 4-lobed .... **4. C. puberula**
+ Lip 3-lobed 3

3. Leaf 1, linear .... **2. C. nana**
+ Leaves 2–5, narrowly oblong .... **3. C. pauciflora**

1. C. chrysea (W.W. Smith) P.F. Hunt in Kew. Bull. 26(1): 174 (1971). Type: China, SE Tibet (Xizang), Tsarong province, Doker-la, *Forrest* 14738 (holo. E!).
Habenaria chrysea W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 13: 204 (1921).
Orchis chrysea (W.W. Smith) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 19: 372 (1924).
Ponerorchis chrysea (W.W. Smith) Soó in Acta Bot. Acad. Sci. Hung. 12: 353 (1966).

Plant 5–9.5cm tall; *tuber* globose, 5–7 × 5–7mm. *Stem* bearing bladeless sheaths at base, bracteate above the leaves; basal sheaths 1–2, tubular, 0.9–1.1cm long. *Leaves* 2, basal, subopposite, oblong to oblong-laceolate, acute, sheathing at base, 2.4–4 × 0.8–1cm; sheaths 1.3–1.4cm long. *Inflorescence* 1-flowered; floral bract large, leaf-like, oblanceolate, acute, 2–4.5 × 0.4–0.9cm. *Flowers* 2–3cm across, uniformly yellowish to cream; pedicel and ovary stipitate, fusiform, 1–2cm long. *Dorsal sepal* oblong, apiculate, erect, 0.9–1 × 0.4–0.45cm; *lateral sepals* ovate, falcate, acuminate, spreading behind the dorsal sepal, 1 × 0.25–0.3cm. *Petals* broadly ovate, obtuse, base oblique, 1–1.2 × 0.6–0.7cm. *Lip* simple to obscurely 3-lobed, spurred, broadly deltoid-triangular, margins subcrenulate, midrib thickened, 0.9–1.2 × 0.7–1.2cm; *spur* cylindric, lying close to the ovary, rounded at apex, 1.2–1.6cm long. *Column* 4mm tall; anther locules parallel; caudicles short; staminodes short, ovate.

Bhutan: N – Upper Mo Chu (near Lingshi), Upper Bumthang Chu (Chamka, Marlung) and Upper Kuru Chu (Narim Thang) districts. Open grassy meadows; 4110–4270m. Fl. July–August.

GENERAL DISTRIBUTION. China.
ETYMOLOGY. From the Greek *chryso-* (golden-yellow) in reference to the flower colour.

2. C. **nana** (King & Pantling) Pradhan, Indian Orch.: Guide Identif. Cult. 2: 678 (1979). Type: China (Xizang), Chumbi, *Pantling* 326 (holo. CAL, iso. AMES! K! L!).

Orchis chusua var. *nana* King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 304, t.402 (1898).

O. nana (King & Pantling) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 9: 434 (1911).

Ponerorchis nana (King & Pantling) Soó in Acta. Bot. Acad. Sci. Hung. 12: 353 (1966).

Chusua roborowskyi var. *nana* (King & Pantling) P.F. Hunt in Kew Bull. 26(1): 176 (1971).

Ponerorchis chusua subsp. *nana* (King & Pantling) Soó in Acta. Bot. Acad. Sci. Hung. 20(3–4): 352 (1974).

Ponerorchis chusua var. *nana* (King & Pantling) R.C. Srivastava, Fl. Sikkim 1: 108 (1996).

Plant 5–8cm tall; *tuber* small, ovoid, 7–8 × 7–8mm. *Stem* slender, glabrous, bearing a bladeless sheath at base, ebracteate above leaf, 3.5–6.5cm long; basal sheath tubular, 1.3–1.7cm long. *Leaf* single, linear to linear-lanceolate, acute, sessile, not sheathing, 1.7–3.5 × 0.15–0.2cm. *Inflorescence* 2-flowered; rachis short, glabrous, 0.5–1.4cm long; floral bracts lanceolate, acute, margins minutely glandular, 0.9–1.1 × 0.2–0.25cm. *Flowers* 5–8mm across; sepals and petals purple, lip purple with red spots; pedicel and ovary fusiform, 7–8mm long. *Sepals* subsimilar, lanceolate-ovate, acute, 1-veined, 2.5–3 × 2–3mm. *Petals* ovate, acute, 1-veined, 2–3 × 1.5–2.5mm. Lip obscurely 3-lobed, spurred, base broad, expanding to an equally 3-lobed apex, margins crenulate, 5–6 × 5–6mm; spur cylindric, wider at base, apex curved, 4–7mm long. *Column* 1–1.5mm tall; pollinia clavate; caudicle long.

Bhutan: C – Bumthang district (Tsochen Chen); **Sikkim** (top of Gangtok); **Chumbi** (unlocalised *Pantling* specimen). Grassy trail-side at margin of *Picea* and *Quercus semecarpifolia* forest; 3200–3600m. Fl. August.

GENERAL DISTRIBUTION. NE India and China (Xizang).

ETYMOLOGY. From the Greek *nanos* (dwarf) in reference to the plant size.

NOTES. This species is very closely related to C. *pauciflora* and Lang (1999) treated it as conspecific. It cannot be distinguished by any reliable floral features but it has a single linear leaf. This feature probably justifies its retention as a separate species, but future collections may show it to be no more than a reduced form of C. *pauciflora*.

3. C. **pauciflora** (Lindl.) P.F. Hunt in Kew Bull. 26(1): 175 (1971). Type: Russia, Dahuria, Fischer s.n. (holo. K-LINDL!).

Orchis chusua D. Don, Prodr. Fl. Nepal: 23 (1825). Type: Nepal, Gossainthan, *Wallich* s.n. (holo. BM!).

Gymnadenia puberula Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 280 (1835), nom. nud. Type: Nepal, Gossainthan, *Wallich* 7059 (holo. K-LINDL!, iso. K-W! K!).

G. pauciflora Lindl., loc. cit. (1835).

Orchis pauciflora sensu Fischer ex Lindl., loc. cit. (1835), nom. nud., non Tenore (1810).

Habenaria chusua (D. Don) Bentham in J. Linn. Soc. 18: 355 (1881).

Orchis giraldiana Kränzlin ex Diels in Bot. Jahrb. Syst. 36(Biebl.82): 25 (1905). Type: China, *Giraldi* 6907 (holo. B).

O. delavayi Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 9: 433 (1911). Type: China, Yunnan, *Delavay* 3989 (holo. B†, iso. K!).

O. beesiana W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 8: 193 (1914). Type: China, Lichiang, *Forrest* 6464 (holo. E).

O. mairei Léveillé, Cat. Pl. Yun-Nan: 197 (1916). Type: China, Yunnan, *E. Maire* s.n. (holo. P).

O. tenii Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 17: 22 (1921). Type: China, Yunnan, *S. Tén* s.n. (holo. B).

O. unifoliata Schltr., loc. cit. (1921). Type: China, Xizang, *Pratt* 11 (holo. B†, iso. K!).

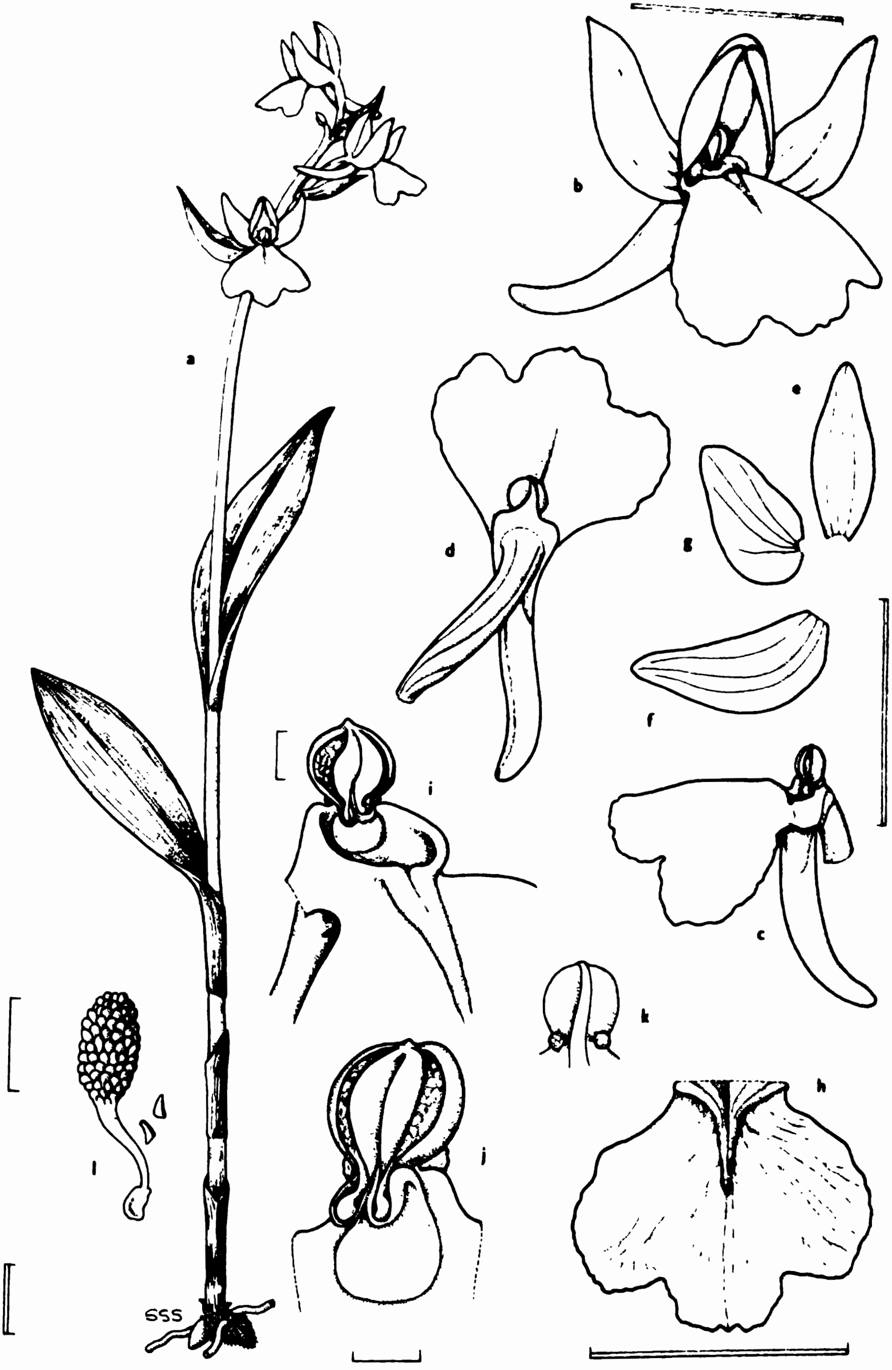


Fig. 36. **Chusua pauciflora**: a, habit; b, flower; c, lip, spur and column; d, lip, ovary and column (back view); e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column with lip base; j, column; k, anther (back view); l, pollinarium with massulae. Drawn by Susanna Stuart-Smith from *Bedi* 395 (K).

O. pulchella Handel-Mazzetti, Symb. Sin. 7: 1325 (1936). Type: China, Yunnan, *Handel-Mazzetti* 9929 (holo. WU).

O. parvifloroides Handel-Mazzetti, *op. cit.* 1327 (1936). Type: China, Yunnan, *Handel-Mazzetti* 9928 (holo. WU).

Ponerorchis chusua (D. Don) Soó in Acta Bot. Acad. Sci. Hung. 12: 352 (1966).

Plant 5–40cm tall; *tuber* small, ellipsoid, 5–8 × 5–8mm. *Stem* glabrous, bearing bladeless sheaths at base, ebracteate above leaves, 9–21cm tall; basal sheaths 1 or 2, tubular, obtuse, 2–3cm long. *Leaves* 1–2(–5), distant along stem, narrowly oblong, acute, sheathing at base, 3–15 × 0.5–1.8cm; sheaths clasping, 0.7–1.5cm long. *Inflorescence* secund, 3- to 6-flowered; rachis glabrous, 2–4cm long; floral bracts lanceolate, acute to acuminate, leaf-like, margins minutely glandular, 1–1.4 × 0.2–0.3cm. *Flowers* 1.5–2cm across, uniformly purple-pink, pollinia white; pedicel and ovary fusiform, 0.9–1cm long. *Dorsal sepal* oblong, obtuse, hooded with petals, 4–7 × 2.2–3mm; *lateral sepals* similar, oblique, recurved, 7–8 × 2.5–4mm. *Petals* broadly ovate, asymmetric, subacute, base truncate, 4–6 × 2.2–3mm. *Lip* variably 3-lobed, shortly clawed at base, spurred, margins entire to sub-crenulate, 0.8–1.1 × 0.7–1.3cm (when spread); lateral lobes diverging, ovate, rounded, 6–8 × 3–3.5mm; mid-lobe broadly ovate, rounded, 4–5 × 3–3.5mm; *spur* cylindric, subclavate, appressed to ovary, 0.9–1.1 × 0.15–0.2mm, mouth wide. *Column* 1.5–2mm tall; anther locules parallel; pollinia ovoid-globose; caudicle long, tapering; viscidia small, ovate-oblique, within bursicle; staminode large, rugulose, ovate; stigmas conjoined. **Fig. 36; Plate 5.**

Bhutan: C – Ha (Ha to Chelai La, Tale La to Tremo La), Thimphu (Barshong, Dotena, above Thimphu Hospital, E of Thimphu, Pajoding), Punakha (Ritang), Punakha/Tongsa (Pele La) and Bumthang (Chakong, Dhur Chu, Lami Gompa, Peipe La) districts; **N** – Upper Mo Chu (Gasa, Laya, Lingshi, near Tatsi Markha, Yale La to Tremo La), Upper Mangde Chu (Worthang), Upper Bumthang Chu (Kantanang, Pangotang, Shimitang) and Upper Kulong Chu (Me La Chu Valley, Shingbe) districts; **Darjeeling/Sikkim** (Sandakphu to Phalut (F.E.H.2)), Singalila Mountains); **Sikkim** (Chamnagu, Chaunrikhiang, Chemathang, Gangtok, Goecha La, Lachen, Lonok?, Phalut, Phedup, E Rathang glacier, Samdong, Samiti Lake, Talam, Tangu Chu, Thanggu, Yampung, Zema); **Chumbi** (Chho La, Dotag, Rinchengang, Trakarpo,Yatung). On sandy flats by lake, short, dry, open grassland on hill-top, in meadows, in rocky areas and open ground among *Potentilla* and dwarf *Rhododendron* scrub, in clearings in *Abies* forest, on marshy streamside in open *Juniperus* and *Berberis* scrub, under *Rhododendron* in dense fir/bamboo/rhododendron forest; 2890–4880m. Fl. June–September.

GENERAL DISTRIBUTION. NE India, Nepal and China.

ETYMOLOGY. From the Latin *pauci-* (few) and *-florus* (flowered).

NOTES. Although the earliest valid name is *Orchis chusua*, the epithet cannot be transferred to *Chusua* so the next valid name, *Gymnadenia pauciflora* Lindl., has to be used (Hunt, 1971). An extended synonymy can be found in Lang (1999).

4. **C. puberula** (King & Pantling) N. Pearce & P.J. Cribb, **comb. nov.** Type: India, Sikkim, Lachung valley, *Pantling* 478 (holo. CAL, iso. AMES! K! W!).

Orchis puberula King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 304, t.403 (1898).

Amitostigma puberulum (King & Pantling) T. Tang & F.T. Wang in Bull. Fan Mem. Inst. Biol. ser.7: 6 (1936).

Ponerorchis puberula (King & Pantling) Vermeulen in Jahresber. Naturwiss. Ver. Wuppertal. 25: 30 (1972).

Plant 8–16cm tall; *tuber* globose to subellipsoid, 4–9 × 8–8mm. *Stem* slender, bearing bladeless sheaths at base, ebracteate above leaf, 6.5–12cm long; basal sheaths 1 or 2, tubular, overlapping, 0.7–1.4cm long. *Leaf* 1, linear, acute, sessile, not sheathing, 3–5.5 × 0.1–0.3cm. Inflorescence laxly 2- to 5-flowered; rachis glabrous, 0.7–3cm long; floral bracts lanceolate, acute, margins minutely glandular, 4–6 × 1.2–1.8mm. *Flowers* 0.6–1cm long, uniformly white or pale pink; pedicel and ovary fusiform, 6–9mm long. *Dorsal sepal* ovate, subacute, concave, puberulous externally, keeled, 1-veined, 2.5–3 × 1–1.5mm; *lateral sepals* ovate, oblique, subacute, spreading, 1-veined, 3–3.5 × 0.8–1.2mm. *Petals* lanceolate, subacuminate, falcate, 1-veined, 2–2.2 × 0.7–1.2mm. *Lip* 4-lobed, spurred, surface densely pubescent, 5–7 × 3–6mm (across lateral lobes when spread); lateral lobes broadly oblong, apex truncate, 2–4.5 × 0.8–1.8mm; mid-lobe 2-lobulate, each lobule oblong, truncate, 3–3.2 × 1.8–2.5mm (across lobules); *spur* cylindric, subacute, 2.2–3.5mm long. *Column* 1–1.5mm tall; anther locules parallel; pollinia sub-obovoid; caudicles clavate; viscidia small; staminodes elongate.

Bhutan: C – Bumthang district (tributary valley 2km N of Byakar Dzong, Kyi Kyi La, Lami Gompa, Ura La); **Sikkim** (Lachung, Yakche). On shaded banks, at margin of a boggy flush and marshy land; 2760–3600m. Fl. June–July.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Latin *puberulus* (minutely pubescent) in reference to the floral parts.

NOTES. King & Pantling (1898) commented that the viscidia were partly covered by a small, tongue-like rostellar pouch, a feature consistent with its inclusion in *Chusua*. It is related to *C. pauciflora* but has puberulous, strongly keeled petals and a puberulous, 4-lobed lip.

36. **Coeloglossum** Hartman

Plants terrestrial, small; *tubers* palmately 2- or 3-lobed, elongate. *Stem* leafy. *Leaves* oblong to elliptic, the upper narrow. *Inflorescence* terminal, racemose, subdensely few- to many-flowered; floral bracts leaf-like. *Flowers* small, green; ovary sessile. *Dorsal sepal* ovate; *lateral sepals* obliquely ovate. *Petals* linear. *Lip* spurred, deflexed, wedge-shaped to oblong, 3-toothed; *spur* short. *Column* short; anther locules divergent; staminodes short, orbicular; rostellum triangular-hooded; pollinia caudate; viscidia remote, 2, covered by a thin membrane; stigmas orbicular-triangular or reniform.

The genus *Coeloglossum* was established in 1820 by Carl Johan Hartman in his *Handbok i Skandinaviens Flora*. DNA analysis of *Dactylorhiza* and *Coeloglossum* (Bateman *et al.*, 1997) demonstrated that *C. viride* was nested within *Dactylorhiza* and they wrongly reduced *Coeloglossum* to the synonymy of *Dactlyorhiza* though *Coeloglossum* is the earlier name. To overcome this difficulty, they intend to conserve *Dactylorhiza* over *Coeloglossum* but have yet to propose this. We have decided to retain the concept of *Coeloglossum* here to avoid unnecessary confusion. The genus comprises about five species widely distributed across the northern temperate zone.

Silen (1906) reported pollination of *C. viride* (L.) Hartman by species of *Cryptus* (wasp), *Tipula* (mosquito) and *Canthanis* (beetle).

TYPE. *Coeloglossum viride* (L.) Hartman; basionym: *Satyrium viride* L.

ETYMOLOGY. From the Greek *coelos* (hollow) and *glossa* (tongue), a reference to the form of the lip.

1. C. viride (L.) Hartman, Handb. Skand. Fl. ed.1: 329 (1820). Type: Herb. LINN 1055.3 (lecto. LINN!), designated by Renz in Nasir & Ali, Flora of Pakistan 164: 32 (1984).

Satyrium viride L., Sp. Pl. 2: 944 (1753).

Orchis bracteata Mühlenberg ex Willdenow, Sp. Pl. ed.4(1): 34 (1805). Type: USA, Philadelphia, *Mühlenberg* 319 (holo. B-W!).

Coeloglossum bracteatum (Mühlenberg ex Willdenow) Schltr. in Feddes Repert. Spec. Nov. Regni Veg 16: 374 (1920).

C. viride var. *virescens* (Mühlenberg ex Willdenow) Luer, Native Orchids of US & Canada: 172 (1975).

C. viride subsp. *bracteatum* (Mühlenberg ex Willdenow) Hultén, Fl. Alaska: 319 (1920).

Dactylorhiza viridis (L.) R.M. Bateman, A.M. Pridgeon & M.W. Chase in Lindleyana 12(3): 129 (1997).

Plant 6–35cm tall; tubers 2, each divided into 2 or 3 finger-shaped segments; roots clustered from tuber. *Stem* glabrous, with a bladeless basal sheath, 10–15cm long; basal sheath tubular, 2–4cm long,

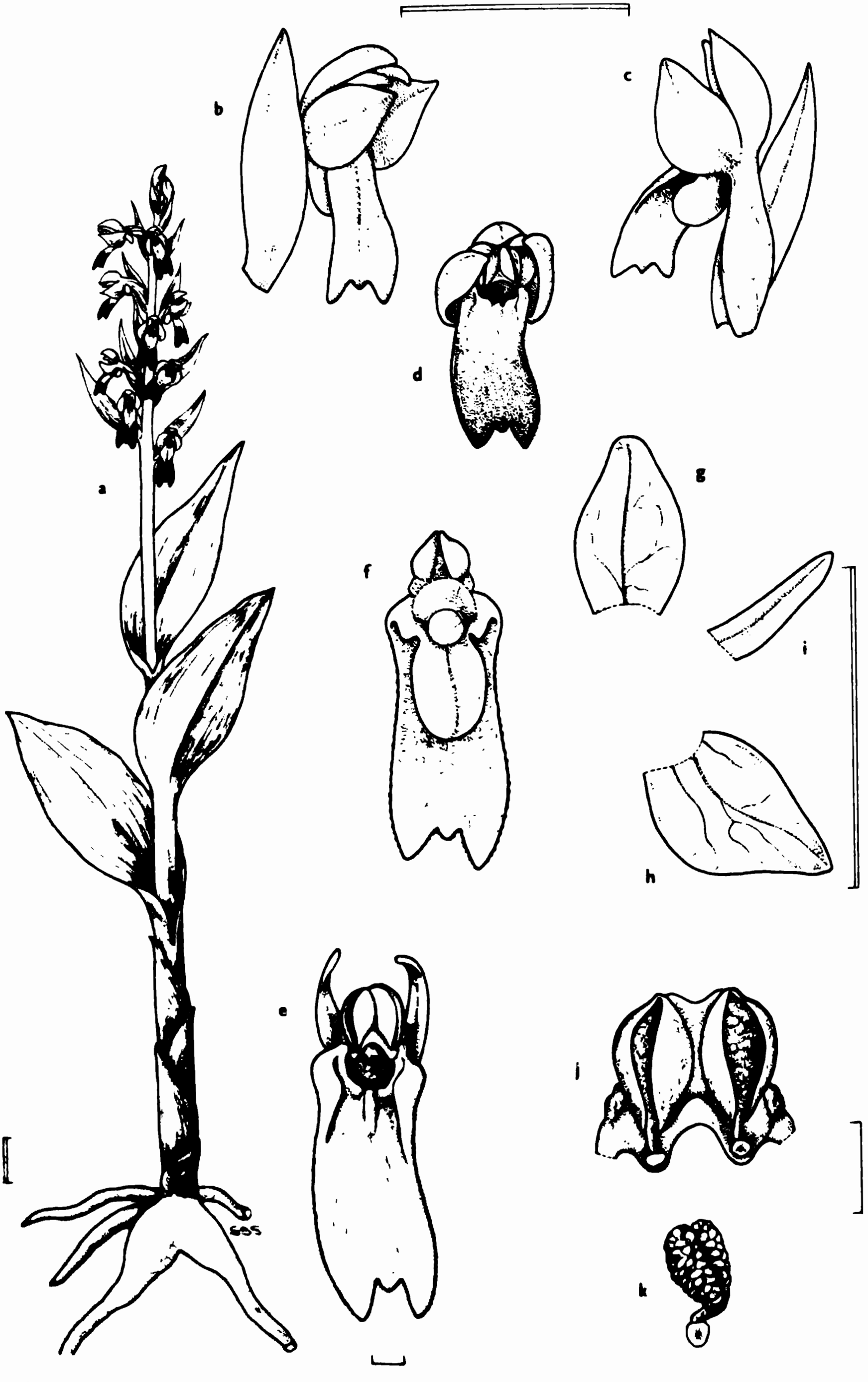


Fig. 37 **Coeloglossum viride** a, habit; b, flower and bract; c, flower, ovary and bract; d, flower (front view); e, lip, petals and column (sepals removed); f, lip, column and spur (back view); g, dorsal sepal; h, lateral sepal; i, petal; j, column, k, pollinarium. Drawn by Susanna Stuart-Smith from *Stainton* 8695 (K).

mouth widely open. *Leaves* 3–5, lanceolate, broadly elliptic to oblong, acute, usually alternate, finely reticulate, equidistant, base long-sheathing, 3–12 × 0.6–6.5cm. *Inflorescence* laxly to densely many-flowered; rachis glabrous, 2.5–5.5cm long; floral bracts variable, long-lanceolate, acuminate, becoming smaller upwards, 0.8–5.8 × 0.15–0.3cm. *Flowers* 2–3cm across, green, suffused with red-brown; pedicel and ovary sessile, twisted, 7–8mm long. *Dorsal sepals* ovate, hooded, 4–6 × 3–4mm; *lateral sepals* ovate, oblique, 5–6 × 3–4mm. *Petals* linear-lanceolate, acute, 4 × 1mm. *Lip* simple, spurred, oblong to wedge-shaped, deflexed, 3-toothed (the lateral teeth longer), thickened on each side near the column, 6–8 × 2–3mm; disc with a longitudinal central keel from base to near the apex; spur saccate, slightly dilated towards apex, 2–3mm long. *Column* 2mm tall; viscidia 2, partly covered by a thin membrane; stigma reniform, c.0.8mm across. **Fig. 37; Plate 5.**

Bhutan: N – Upper Kulong Chu district (Shingbe). Open grassland, in upper montane *Betula*/*Rhododendron*/*Lonicera* forest; 3550–4500m. Fl. June–August.

GENERAL DISTRIBUTION. Widespread across Europe and Asia, N America.
ETYMOLOGY. From the Latin *viridis* (fresh green) in reference to the flower colour.
NOTES. *C. viridis* is extremely variable in terms of stature and length of the floral bracts. Nevski (in Komarov, 1935) considered that European, Russian and oriental plants could not be distinguished from *C. bracteatum* which he therefore treated in the synonymy of *C. viride*. Renz (1978) discussed this variability and also felt that it was not possible to separate individuals with long bracts at either specific or subspecific rank, and we follow this treatment here. Luer (1975) sank *C. bracteatum* into a new variety that he called *C. viride* var. *virescens* (Mühlenberg ex Willdenow) Luer. The synonymy excludes most of the American names and a more complete list can be found in Luer (1975) and Lang (1999).

37. **Diphylax** Hook. f.

Plants terrestrial, small; *rhizome* slightly elongate; *tuber* small, narrowly oblong. *Stem* flexuose or straight. *Leaves* 1–3, if single then central on stem, if 2 or more, then basal. *Inflorescence* terminal, racemose, sublaxly many-flowered, secund; floral bracts equalling the ovary. *Flowers* small. *Sepals* and *petals* entire, subsimilar. Lip entire to distally 3-lobed, spurred, ecallose; spur ellipsoid. *Column* short; anther locules parallel or minutely divergent, canals short; pollen grains coarsely granular; pollinia 2, clavate; caudicle very short; viscidia relatively large; staminodia elongate-filiform; stigma slightly convex, confluent or 2-lobed.

The genus Diphylax was established in 1889 by J. D. Hooker in his *Icones Plantarum*. The genus comprises three species distributed in the mountain regions of Afghanistan, Pakistan, India, Bhutan and China.

Diphylax is related to *Habenaria* and Hooker later placed our species in its own section of *Habenaria* (Hooker, 1890). Cribb (in press) considers that the Chinese genus *Tsaiorchis* T. Tang & F.T. Wang, should be reduced to the synonymy of *Diphylax*.

TYPE. *Diphylax urceolata* (C.B. Clarke) Hook. f.; basionym: *Habenaria urceolata* C.B. Clarke.
ETYMOLOGY. From the Greek di- (two) and phylax (guard) in reference to the two guard-like staminodes on either side of the anther.

1. **D. urceolata** (C.B. Clarke) Hook. f., Icon. Pl. 19(n.s.9): t.1865 (June 1889). Types: India, Naga Hills, Jakpho, *Clarke* 41272 (syn. K!); Sikkim, Yak La, *Clarke* 10244 (syn. K!, isosyn. HBG!).
Habenaria urceolata C.B. Clarke in J. Linn. Soc., Bot. 25: 73, t.30 (February 1889).

Plant 9–15cm tall; *rhizome* long-pubescent. *Stem* erect-curved, slender, glabrous, bearing a bladeless basal sheath, 5–8cm long; basal sheath tubular, 1.2cm long, mouth narrow. *Leaf* usually single (with 1 or 2 leaf-like bracts above), narrowly elliptic-oblong, subacute to obtuse, tapered to a petiolate, sheathing base, 3–7.5 × 0.6–1.2cm; petiole 4–6mm long; leaf-like bracts lanceolate, acute,

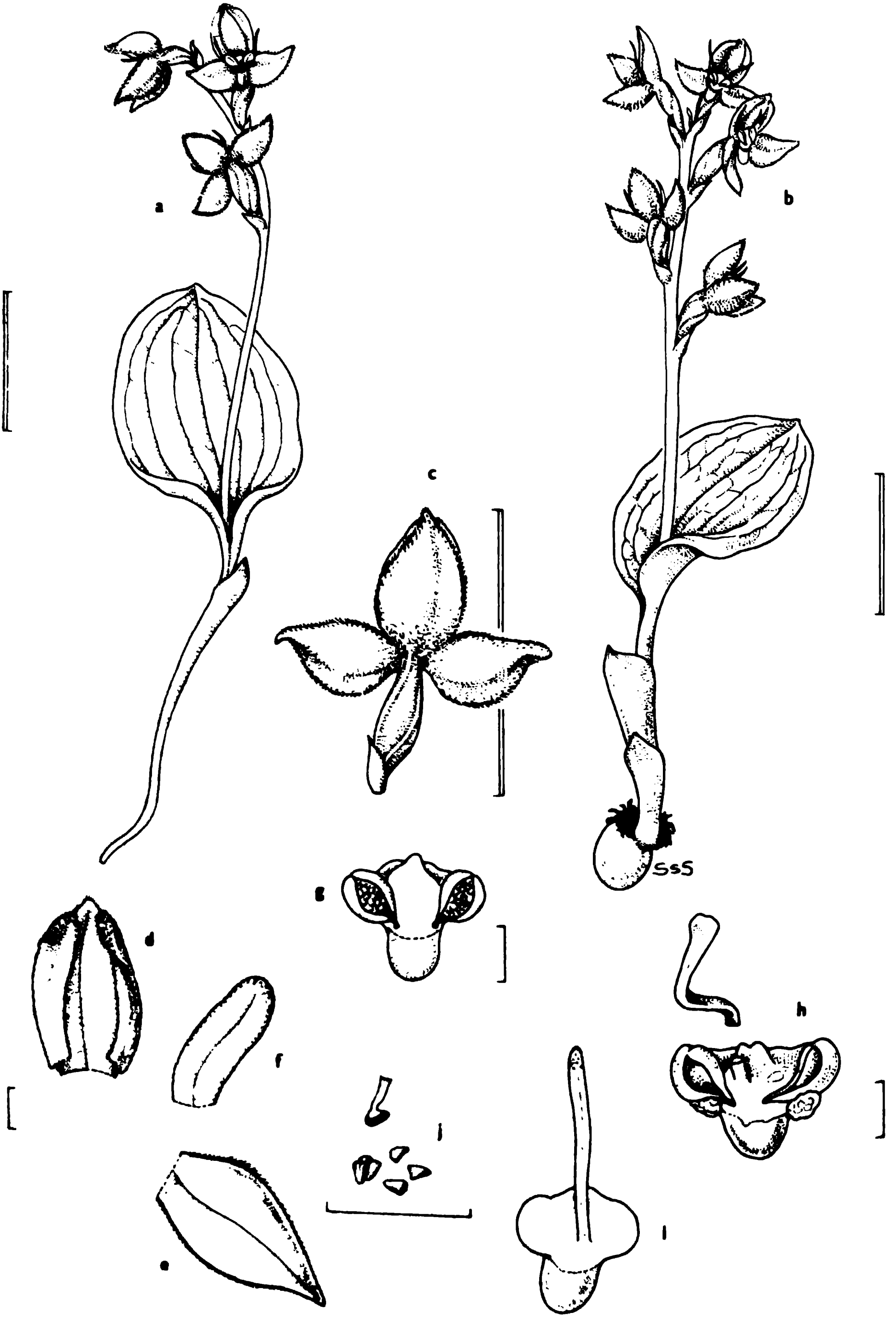


Fig. 38. Diphylax sp.: a–b, habit; c, flower (back view); d, dorsal sepal and petals; e, lateral sepal; f, petal; g, column; h, column (with staminode detached); i, staminode; j, viscidium and massulae. Drawn by Susanna Stuart-Smith from Rohmoo 1161 (E)

6–8 × 1–2mm. *Inflorescence* decurved, laxly 7- to 10-flowered; rachis 2–4cm long; floral bracts narrowly oblong-lanceolate, acute, 4–11 × 0.5–0.8mm. *Flowers* not opening fully, 6–9mm long; sepals and petals white to pink, lip greenish; pedicel and ovary 3–4mm long. *Dorsal sepal* elliptic, obtuse, 1-veined, 5–6 × 1–1.4cm; *lateral sepals* lanceolate-oblong, falcate, acute, 1-veined, 5–6 × 1–1.4cm. *Petals* oblong, acute, narrowed towards base, 1-veined, 4–5 × 0.8–1mm. *Lip* 3-lobed, spurred, 5–7mm long; lateral lobes short, triangular, rounded; mid-lobe decurved, concave, thickened at apex, margins serrulate; spur urceolate, constricted at neck, inflated below, 1.5–3mm long. *Column* elongate, apex pointed, 1–2mm long; staminodes filiform, c.3mm long. *Fruit* ovoid, 5–6 × 2–3mm.

Bhutan: C – Thimphu (ridge S of Dochu La) and Tashigang (Dib La) districts; **Darjeeling** (Richi La); **Sikkim** (Meguthang, Yak La, Zemu Chhu). On mossy banks in very moist, evergreen, broad-leaved forest, in *Rhododendron barbatum* and Tsuga forest; 2740–4270m. Fl. September–October.

GENERAL DISTRIBUTION. India (Himalayas) and China (Yunnan).

ETYMOLOGY. From the Latin *urceolatus* (pitcher-, vase- or urn-shaped) referring to the spur.

NOTE. The urceolate spur is characteristic of this species.

Imperfectly known species.

Diphylax sp. *Rohmoo* 1161 (E).

Plant 3–10cm tall; tubers ovoid, 0.5 × 0.3mm. *Stem* slender, glabrous, sheathed at base; sheaths tubular, expanding above, apex 2-lobed, 1.9–2.1cm long. *Leaf* single, spreading, sessile, elliptic-ovate, apex subacute, base enveloping the stem, margins entire to weakly undulate, 2–3.5 × 1.2–1.8cm. *Inflorescence* ± laxly 7- to 8-flowered; rachis glabrous; floral bracts small, ovate-triangular, apiculate, 2 × 2mm. *Flowers* 0.6–1cm across, uniformly white; pedicel and ovary spirally twisted, glabrous, 3–5mm long. *Dorsal sepal* ovate, obtuse, glandular-hairy, hooded, 4–5 × 1.5–2mm; *lateral sepals* lanceolate, obtuse, glandular-hairy, spreading, 4.5–5 × 1–1.5mm. *Petals* oblong, obtuse, 4–4.5 × 0.5–1mm. *Lip* (absent from the single damaged specimen); *spur* short, cylindric, 1.5 × 0.8mm. *Column* broad, c.0.5mm tall; staminode elongate, filiform, 3–5mm long. **Fig. 38.**

NOTES. Renz (pers. comm.) suggested that this specimen (from Chiya Bhanjang, Sikkim, 3350m) might represent an undescribed species of *Diphylax*. It is, however, damaged and the lip is missing. We do not feel able to reach a conclusion from this specimen and further collections are required.

38. Diplomeris D. Don

Plants terrestrial; *tuber* ± spherical. *Stems* short. *Leaves* 1 or 2, large, oblong to ensiform, pubescent or glabrous. *Inflorescence* 1- or 2-flowered. *Flowers* large. *Sepals* subsimilar, lanceolate, free, spreading. *Petals* larger than the sepals. *Lip* adnate to base of the column by a long claw, spurred; lamina spreading, broad, entire to minutely 3-lobed. *Column* very short; rostellum large, erect, membranous; anther locules parallel; pollinia 2, subcylindric, curved; caudicles long, cylindric; viscidia minute, discoid; stigmas 2, elongate, oblong, parallel.

The genus *Diplomeris* was established in 1825 by David Don in his *Prodromus Florae Nepalensis*. The genus comprises four species occurring in India, Nepal and China.

TYPE. *Diplomeris pulchella* D. Don.

ETYMOLOGY. From the Greek *diplos* (double) and *-meris* (portion) referring to the two, appendix-like projections on the column.

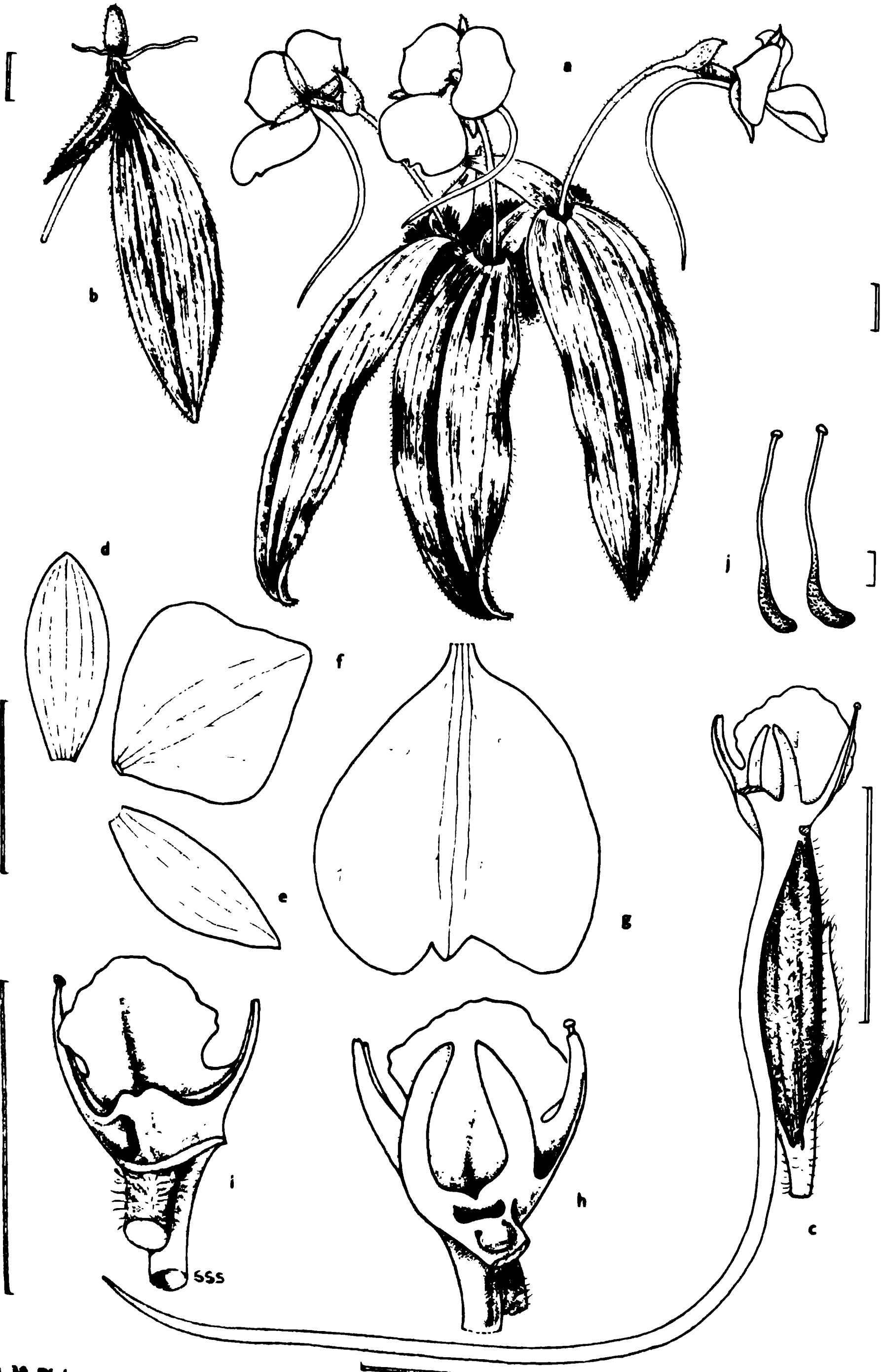


Fig 39. ***Diplomeris hirsuta***: a, habit; b, leaves and tuber; c, lip, ovary and bract; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (front view), i, column (back view); j, pollinaria. Drawn by Susanna Stuart-Smith, a–b from *Pantling* 184 (K); c–j from *Rain* 9586 (K).

1. D. hirsuta (Lindl.) Lindl., Gen. Sp. Orchid. Pl.: 330 (1835). Type: Nepal, Gossainthan, *Wallich's collectors* Wall. Cat. 7065 (holo. K-LINDL!, iso. K-W!).
Diplochilus hirsuta Lindl. in Bot. Reg. 18: sub t.1499 (1832).
D. hirsuta var. *biflora* Pradhan in Amer. Orchid Soc. Bull. 43(6): 525 (1974).

Plant 5–7cm tall; *tuber* spherical-ellipsoid, 0.7–1 × 0.5–0.7cm. *Stem* short, lacking basal bladeless sheaths, sparsely pubescent, 2.5–3.5cm long. *Leaf* 1 (occasionally with a second small subopposite leaf), basal, oblong, subacute, base weakly cordate, sessile, stiffly pubescent, sheathing at base, 3.5–8 × 1.4–3.8cm; leaf sheath 5–7mm long. *Inflorescence* 1- or 2-flowered; floral bract ovate, acute, stiffly pubescent, 1–1.2 × 0.7–0.8cm. *Flower* 2.5–3cm across, uniformly pure white; pedicel and ovary narrowly oblong, sparsely pubescent, 1.1–1.5cm long. *Dorsal sepal* ovate-oblong, subacute, sparsely pubescent externally, 1.1–1.6 × 1.1–1.2cm; *lateral sepals* oblong-ovate, falcate, pubescent externally, 1.2–1.5 × 0.7–0.8cm. *Petals* orbicular-reniform, subacute, 1–2.1 × 0.7–1.7cm. *Lip* simple, spurred, clawed at base; apical lobe broadly ovate-orbicular, apex broadly 2-lobed, emarginate, mucronate, midrib thick, 2–2.3 × 2.2–2.4cm (when spread); spur long, funnel shaped at base, cylindric below, curved, pubescent within, 4.5–5.5cm long. *Column* 5–7mm tall; stigma large, slender, erect, broadly ovate, margin irregularly lobed; anther locules triangular with long tubes, c.6mm long; staminodes small, oblong, rugulose; pollinia cylindric; caudicle very long, curved; viscidia small, discoid; stigmas 2, oblong. **Fig. 39.**

Terai (Siliguri); **Darjeeling** (near Coronation Bridge, Kali Khola, Sivok). On sandstone rocks with *Colocasia affinis*, *Utricularia*, *Begonia* and *Globba* sp.; 200–750m. Fl. June–August.

GENERAL DISTRIBUTION. Nepal, NE India and China.
ETYMOLOGY. From the Latin hirsutus (roughly hairy) in reference to the leaves, stem and ovary.
NOTES. This rather attractive plant is sometimes known as the 'snow orchid'; it is related to D *pulchella* D. Don but that species is glabrous.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

D. pulchella D. Don, Prodr. Fl. Nepal: 26 (1825). Type: Nepal, *Wallich* s.n. (holo. BM!).

NOTES. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh, but we have seen no material from our area.

39. Gymnadenia R. Br.

Plants terrestrial; *tuber* flattened, palmately lobed. *Stem* erect, leafy (especially near base). *Leaves* linear to linear-lanceolate, conduplicate, unspotted. *Inflorescence* terminal, racemose, cylindric or capitate, densely many-flowered; floral bracts shorter than or equalling ovary. *Flowers* small, resupinate to non-resupinate; ovary cylindric, sessile, twisted, glabrous. *Sepals* and *petals* similar, free, spreading; *dorsal sepal* forming hood with petals; *lateral sepals* spreading, decurved. *Lip* shortly 3-lobed to entire, spurred; *spur* short to long, often filiform. *Column* short; stigmas 2, lateral; rostellum elongate to small, 3-lobed, folded between the anther locules; pollinia 2, clavate; caudicle attached to a free viscidium (bursicle absent).

The genus *Gymnadenia* was established in 1813 by Robert Brown in the second edition of Aiton's *Hortus Kewensis*. The genus comprises about 16 species distributed in Europe, central and eastern Asia, China, Japan and the Himalayas.

TYPE. *Gymnadenia conopsea* (L.) R. Br.; basionym: *Orchis conopsea* L.
ETYMOLOGY. From the Greek *gymno-* (naked) and *aden* (gland) in reference to the viscidia which are free on each side of the rostellum and not enclosed in a bursicle.

Key to species

1. Lip distinctly 3-lobed .... **1a. G. orchidis var. orchidis**
+ Lip obscurely 3-lobed or unlobed .... **1b. G. orchidis var. pantlingii**

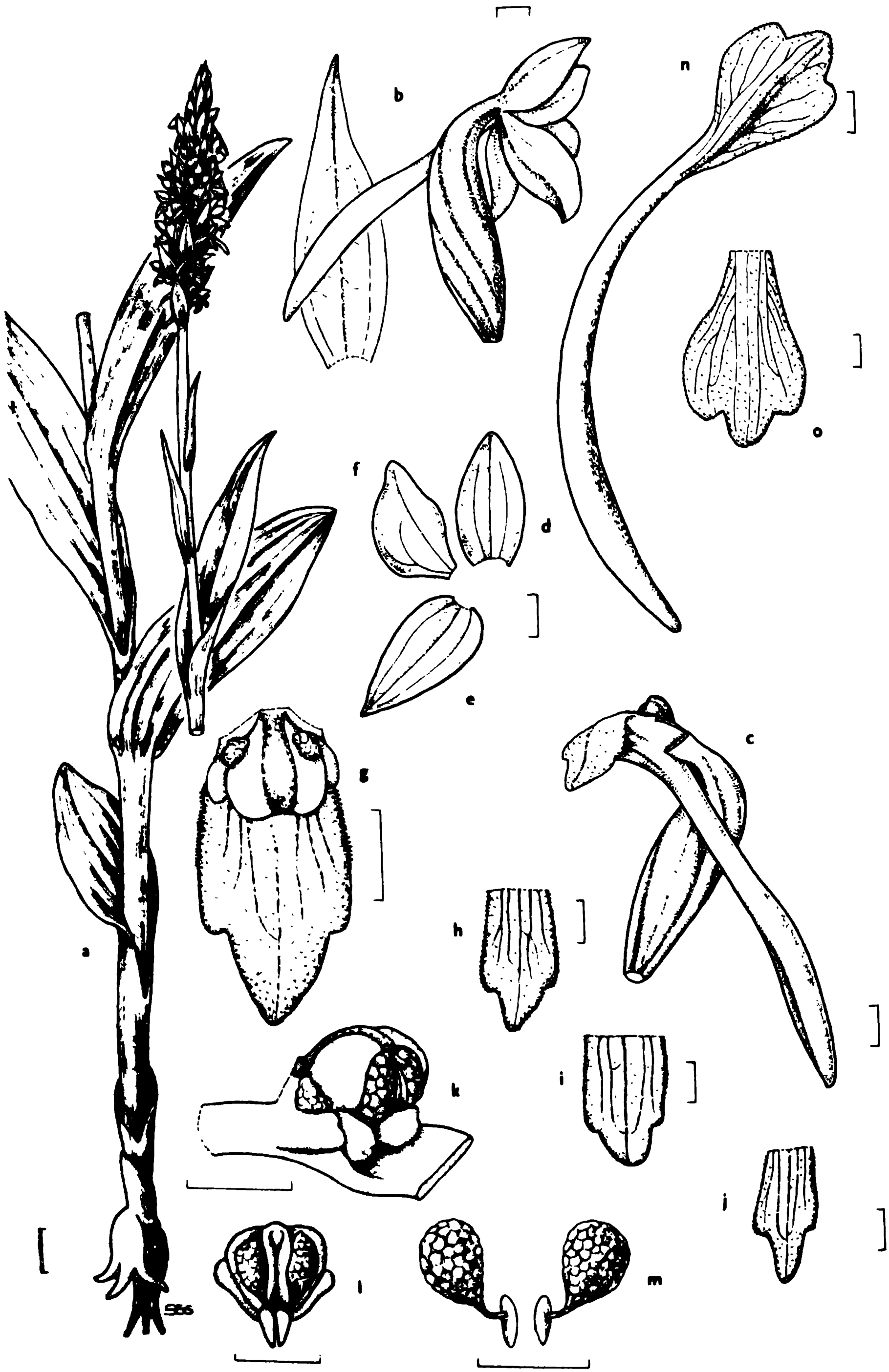


Fig 40 **Gymnadenia orchidis** var **pantlingii**: a, habit; b, flower with bract; c, lip, spur and ovary; d, dorsal sepal; e, lateral sepal, f, petal; g, lip and column; h–j, lip; k, column; l, anther; m, pollinaria; **G. orchidis** var **orchidis**: n, lip with spur; o, lip. Drawn by Susanna Stuart-Smith, a and j from *Pantling* 404B (K); b–i, k–m from *Bedi* 394; n–o from *Wallich* 7039A (K)

1. G. orchidis Lindl., Gen. Sp. Orchid. Pl.: 278 (1835). Type: India, Kamoon, coll. R. Blinkworth Wall. Cat. 7039B (lecto. K-LINDL!, iso. K-W! K!, selected by Pearce *et al.* in Edinb. J. Bot. 58(1): 112 (2001)).

Platanthera orchidis Wall. ex Lindl. in Wall. Cat.:7039A/B (1830), *nom. nud.*

Gymnadenia cylindrostachya Lindl., Gen. Sp. Orchid. Pl.: 278 (1835). Type: India, unlocalised, Wall. Cat. 7056 (holo. K-LINDL!, iso. K-W!).

G. violacea Lindl., Gen. Sp. Orchid. Pl.: 278 (1835), **syn. nov.** Type: India, Mussorree, *Royle* 59 (syn. icon. K-LINDL!, syn. LIV!).

Habenaria orchidis (Lindl.) Hook. f., Fl. Brit. India 6(1): 142 (1890).

H. stoliczkae Kränzlin in Bot. Jahrb. Syst. 16: 215 (1892–3), **syn. nov.** Type: India, Himachal Pradesh, Narkanda, *Stoliczka* 866 (holo. B†).

Peristylus orchidis (Lindl.) Kränzlin, Orchid. Gen. Sp.: 515 (1898).

Orchis habenarioides King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 302, t.401 (1898). Type: India, Sikkim, *Pantling* 404A (holo. CAL, iso. BM! K!).

O. cylindrostachya (Lindl.) Kränzlin in Feddes Repert. Spec. Nov. Regni Veg. Beih. 5: 197 (1919).

Gymnadenia delavayi Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 16: 282 (1919). Type: China, Yunnan, *Delavay* s.n. (holo. B, iso. K! P).

G. himalayica Schltr. *op. cit.* 283 (1919). Type: NW Himalaya, *Duthie's collector* 23341 (holo. B†).

G. souliei Schltr. *op. cit.* 284 (1919). Type: China, Tangut, *Soulié* 2318 (holo. B†).

G. conopsea (L.) R. Br. var. *yunnanensis* Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 105 (1919), *nom. nud.*

G. habenarioides (King & Pantling) Vermeulen in Jahresber. Naturwiss. Vereins Wuppertal 25: 33 (1972).

1a. var. orchidis

Plant 22–60cm tall; tubers stout. Stem stout, bearing bladeless sheaths at base, 20–38cm long. *Leaves* 3–8, elliptic-oblong to linear-oblong, subacute, sessile, sheathing at base, upper leaves bract-like, lanceolate, 5–17.5 × 2–3.6cm. *Inflorescence* densely many-flowered; rachis glabrous, 4–14cm long; floral bracts lanceolate, acute, 1.5–2.7 × 0.25–0.3cm. *Flowers* faintly and sweetly fragrant, 0.6–1cm across, uniformly pink; pedicel and ovary 0.7–1.1cm long. *Dorsal sepal* elliptic, obtuse, 3-veined, 3–6 × 2–3mm; *lateral sepals* spreading, ovate to ovate-lanceolate, obtuse, 3-veined, 3.5–6 × 2–3mm. *Petals* obliquely ovate-orbicular to rhombic-orbicular, 3–6 × 2–3.5mm. *Lip* variable, broadly oblong, truncate, adnate to column base, spurred, broadly 3-lobed towards the apex, 3–3.5 × 2–3mm; base quadrate expanding slightly to the ovate, rounded lateral lobes; mid-lobe broadly circular; *spur* slender, narrow, curved, 0.7–1.7cm long. *Column* 2 × 2.5mm. *Fruit* ovoid, 7–9 × 4–6mm. **Fig. 40n–o.**

Bhutan: C – Ha (Kale La, Tare La), Thimphu (Cheka to Soe, Dotena, Pajoding, Somana?, Tsalimaphe to Pumo La), Punakha (Pho Chu, Tang Chu) and Tongsa/Bumthang (Penge La) districts; **N** – Upper Mo Chu (Lingshi, E bank of Tharizam Chu), Upper Pho Chu (Lunana), Upper Bumthang Chu (Champa, Waitang) and Upper Kulong Chu (Me La, Shingbe) districts; **Darjeeling** (Sandakphu); **Sikkim** (Bijan, Bikbari, Boktak, Lachen, Lachung, Palo, Sherabthang S of Kabur, Tangu, Thangshing); **Chumbi** (Chubitang, Rinchengang, Tangka Chhu, E of Yatung). Grassy meadows and clearings in low *Abies*/*Juniperus*/*Rhododendron* scrub, open grassy hillsides; 3050–4370m. Fl. June–September.

GENERAL DISTRIBUTION. India, Nepal and China.
ETYMOLOGY. A reference to the plant's resemblance to the genus *Orchis*.
NOTES. The roots of this species are used for healing wounds in Sikkim. Kränzlin described *H. stoliczkae* based on a collection from Narkanda that has been destroyed. The description agrees well with that of *G. orchidis* and King & Pantling (1898) listed a collection 'Pangi; Stolickza' under *Orchis habenarioides* (a synonym of *G. orchidis*). We believe it is probably conspecific and reduce it to synonymy here.

1b. var. pantlingii Renz in Edinb. J. Bot. 58(1): 112 (2001). Type: India, Sikkim, Tankra-la, Pantling 404B (holo. BM!, iso. K!).

Habit, stem, leaves and inflorescence similar to var. orchidis. *Flowers* 3–4mm across. *Dorsal sepal* lanceolate, narrowed to acute apex, 3-veined, 3.5–4 × 1.5–2mm; *lateral sepals* ovate-elliptic, subacute, spreading, 3 × 2mm. *Petals* broadly ovate, acute, 2.5 × 2mm. *Lip* simple to obscurely 3-lobed, 3 × 1mm; lateral lobes (when present) narrowly rounded; mid-lobe narrowly oblong, tapered to rounded, papillose apex, 1mm long; *spur* angled, curved forward, 5.5–8.5mm long, incurved 2mm from the apex. **Fig. 40a–m.**

Bhutan: C – Ha (Chelai La) and Thimphu (Pajoding) districts; **Sikkim** (Dzongri, Lachung Valley, Tangkar La, Yampung, Yumthang). In damp meadows and open hillsides; 3580–4270m. Fl. July–September.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after Robert Pantling who collected the type specimen.

40. Habenaria Willdenow

Plants terrestrial (rarely epiphytic); *tubers* pubescent; *roots* long, fleshy. *Stem* erect, few- to many-leaved, bearing bladeless sheaths below. *Leaves* thin-textured, narrowly elliptic to orbicular, sheathing at base, uppermost bract-like. *Inflorescence* terminal, racemose, laxly to densely many-flowered. *Flowers* white, green or pink. *Dorsal sepal* forming a hood over column with the petals; *lateral sepals* spreading or reflexed. *Petals* entire, 2-lobed or bifid. *Lip* spurred, entire or 3-lobed. *Column* short or long; anther erect or reclinate; anther locules adjacent or separated by a U-shaped connective; pollinia 2, sectile clavate; stigmas 2, usually separate on stigma arms anterior on column; caudicles enclosed in long or short tubes (canals or thecae); rostellum 3-lobed.

The genus *Habenaria* was established in 1805 by Carl Ludwig Willdenow in the fourth edition of Linnaeus' *Species Plantarum*. The genus comprises over 600 species widely distributed across all continents (except Antarctica).

Van der Pijl & Dodson (1966) reported moth pollination for a number of *Habenaria* species.

LECTOTYPE. *Habenaria macroceratitis* Willdenow; basionym: *Orchis habenaria* L.
ETYMOLOGY. From the Latin *habena* (reins) in reference to the long, strap-like divisions of the petals and lip of some species.

Key to species

1. Petals 2-lobed 2
+ Petals simple 3

2. Petal segments filiform, of equal length, more than 1.5cm long .... **6. H. pantlingiana**
+ Petal segments linear, of unequal length, less than 0.8cm long (short arm less than 0.2cm long) .... **9. H. stenopetala**

3. Plants with radical to subradical leaves only 4
+ Plants with leaves inserted along the stem 6

4. Plants with 3–7 subradical leaves .... **8. H. plantaginea**
+ Plants with 2 radical to subradical leaves 5

5. Inflorescence densely many-flowered; sepals less than 5mm long; stem above leaves with bracts; tips of lateral lobes of lip not coiled .... **11. H. aitchisonii**
+ Inflorescence subdensely 4- to 6-flowered; sepals more than 5mm long; stem above leaves ebracteate; tips of lateral lobes of lip coiled .... **12. H. diphylla var. josephi**

6. Lateral lobes of lip deeply lacinate to base 7
+ Lateral lobes of lip simple 9

7. Petals pubescent or glandular-pubescent .... 1. **H. arietina**
+ Petals not pubescent 8

8. Sepals and petals green; petals oblong-lanceolate; spur equalling or shorter than the ovary 7. **H. pectinata**
+ Sepals and petals white; petals linear; spur exceeding the ovary .... 10. **H. trichosantha**

9. Spur exceeding the ovary 10
+ Spur shorter than the ovary 11

10. Lateral lobes of lip wedge-shaped, outer margin denticulate .... 2. **H. dentata**
+ Lateral lobes of lip filiform, entire .... 3. **H. furcifera**

11. Spur geniculate; lip greenish .... 4. **H. malleifera**
+ Spur straight; lip yellow .... 5. **H. marginata**

Section **Habenariae**

1. **H. arietina** Hook. f., Fl. Brit. India 6(1): 138 (1890). Types: India, Kamoon (Kumaon), coll. *R. Blinkworth* Wall. Cat. 7029B p.p. (syn. K-LINDL!, isosyn. K-W!); ?India, Mt. Sylhet, coll. *F. De Silva* Wall. Cat. 7029C (syn. K-LINDL!, isosyn. K-W!); India, Sikkim, *Hooker* s.n. (syn. K!); India, Khasia, *Hooker & Thomson* 260A (syn. K-LINDL!, isosyn. K!).

Habenaria pectinata sensu Lindl., Gen. Sp. Orchid. Pl.: 321 (1835), *non* (J.E. Smith) D. Don.
H. pectinata var. *arietina* (Hook. f.) Kränzlin, Orchid. Gen. Sp. 1: 405 (1898).
H. intermedia var. *arietina* (Hook. f.) Finet in Rev. Gén. Bot. 13: 530 (1901).
H. pectinata var. *gigantea* Pradhan, Indian Orch.: Guide Identif. Cult. 1: 73 (1976). Type: India, Khasia, *Hooker & Thomson* 206A (holo. K-LINDL!, iso. K!).
H. pectinata var. *khasiana* Pradhan, *loc. cit.* (1976). Type: India, Khasia, *Griffith* 5307 (holo. K!).

Plant erect, 35–80cm tall; *tuber* fusiform, 2–3.5 × 1.2–1.8cm; *roots* slender, clustered. *Stem* leafy, 6–7mm wide at base, tapering above; basal sheaths tubular, clasping, 4.5–5cm long. *Leaves* 6 or 7, distichous, distant, lanceolate to ovate-lanceolate, acute to subacuminate, sessile, sheathing at base, becoming smaller up the stem, 4–11 × 1.3–2.3cm; sheaths clasping, 1.5–2.5cm long. *Inflorescence* subdensely many-flowered; rachis glabrous, 15–18cm long; floral bracts leaf-like, narrowly lanceolate, acute, 5-veined, margins minutely glandular-pubescent, becoming smaller up the rachis, 1.6–4 × 0.4–0.7cm. *Flowers* 3–5cm across; sepals and petals greenish-yellow, lip greenish-white; pedicel and ovary minutely glandular-pubescent, 2.5–4cm long. *Dorsal sepal* lanceolate, acute, erect, 5-veined, 1.4–2 × 0.4–0.5cm; *lateral sepals* spreading, ovate-lanceolate, oblique, acute, 5-veined, 1.4–2 × 0.4–0.7cm. *Petals* forming hood with dorsal sepal, oblong, oblique, dilated, rounded and gibbous at base, margins glandular-pubescent, 1.4–1.8 × 0.5–0.7cm. *Lip* 3-lobed, spurred, clawed; base narrow, 0.7–1.2cm long; lateral lobes deeply pectinate-fimbriate, inner margin minutely glandular-pubescent, 1.2–1.5 × 0.7–0.9cm (length of fimbriae); mid-lobe simple, linear-oblong, tapering, obtuse, margin minutely glandular-pubescent, 1–1.2cm long; *spur* cylindric, clavate, 2–3cm long. *Column* broad, 3mm tall; stigmas elongate, minutely glandular-pubescent, 6–8mm long; anther locules divergent; pollinia clavate; caudicle elongate; viscidium small; staminodes filiform, 2.5–3mm long.

Bhutan: S – Chukka (S of Chima Kothi, Gedu, Takhti Chu) and Sankosh (Daga Dzong) districts; C – Thimphu (Dotena), Tongsa (Chendebi) and Mongar (Lhuntse, Unjar) districts; **N** – Upper Kuru Chu district (Denchung, near Kurted); **Darjeeling** (Bhotia Basti, Birch Road, Budhwari, Church Hill, Ghoom, Lopchu, Mane Bhanjang, Phalut, Ramman, Rimbik, Senchal, Takdah, Tonglu); **Sikkim** (Dubde Monastery, Lachen, Nanga, Richi La, Tumlong, Yoksam). On grassy banks on exposed, open hillside, in deciduous *Quercus* and moist broad-leaved forest; 1660–3600m. Fl. July–August.

GENERAL DISTRIBUTION. NW India, Nepal, NE India, China and ?Vietnam (Averyanov, 1994).
ETYMOLOGY. From the Latin *arietinus* (resembling the horns of a ram) in reference to the shape of the lateral lobes of the lip.

2. **H. dentata** (Sw.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 125 (1919). Type: E China, *Swartz* s.n. (holo. S!).

Orchis dentata Sw. in Kongl. Vetensk. Acad. Nya. Handl. Stockh. 21: 207 (1800).
Habenaria geniculata D. Don, Prodr. Fl. Nepal: 25 (1825). Type: Nepal, *Buchanan-Hamilton* s.n. (holo. BM).
Orchis geniculata Buchanan-Hamilton ex D. Don, *loc. cit.* (1825), *pro syn.*
Platanthera geniculata Lindl. in Wall. Cat.: 7042 (1832), nom. nud.
P. dentata (Sw.) Lindl., Gen. Sp. Orchid. Pl.: 296 (1835).
Habenaria miersiana Champion in Hooker's J. Bot. Kew Gard. Misc. 7: 37 (1855). Type: Hong Kong, Victoria Peak, *Champion* s.n. (holo. K!).
H. sieboldiana Miquel in Ann. Mus. Bot. Lugduno-Batavi. 2: 208 (1866). Type from Japan.
H. geniculata var. *ecalcarata* King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 310, t.405, f.4–5(1898). Type not specified.
H. miersiana var. *yunnanensis* Finet in J. Bot. (Morot) 12: 341, t.6 (1898). Type: China, Yunnan, *Delavay* 385 (holo. P).
H. geniculata var. *yunnanensis* (Finet) Finet in Rev. Gén. Bot. 13: 530 (1901). Type: China, Yunnan, *Ducloux* 403 (holo. P).
H. tohoensis Hayata, Icon. Pl. Formos.4: 128 (1914). Type from Taiwan.
H. finetiana Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 126 (1919), based on *H. miersiana* var. *yunnanensis* and *H. geniculata* var. *yunnanensis* cited above.
H. tienensis T. Tang & F.T. Wang in Bull. Fan Mem. Inst. Biol. 7: 136 (1936).Types: China, Yunnan, *Ducloux* 191 (syn. K!); China, Yunnan, *Schoch* 320 (syn. K!).
H. dentata var. *ecalcarata* (King & Pantling) Handel-Mazzetti, Symb. Syn. 7: 1336 (1936).
Platanthera dentata f. *ecalcarta* (King & Pantling) Tuyama in Hara, Fl. E. Himal.: 438 (1966), **syn. nov.**
H. dentata var. *tohoensis* S.S. Ying, Coll. Illst. Indig. Orch. Taiwan 1(2): 464 (1977).

Plant erect, 40–80cm tall; *tuber* ellipsoid, pubescent, 2.5–2.8 × 1–1.2cm. *Stem* bracteate above leaves, terete; basal sheaths tubular, 2cm long, mouth wide; stem bracts lanceolate to linear-lanceolate, acute to acuminate, distant, 2.5–3 × 0.2–0.5cm. *Leaves* 3, distant, oblong-elliptic, acute, sessile, sheathing at base, 5.5–12 × 1.8–3.2cm; sheaths tubular, 1.5–3cm long. *Inflorescence* subdensely few- to many-flowered; rachis glabrous, 4–9cm long; floral bracts linear-lanceolate, acuminate, margins minutely pubescent, 1.5–2.5 × 0.1–0.3cm. *Flowers* 1.5–2cm across; sepals and petals white with green veins, lip white, spur green; pedicel and ovary long, slender, twisted, 2–2.5cm long. *Dorsal sepal* ovate to broadly ovate, acute, erect, margins minutely glandular-pubescent, 7–9 × 4–4.5mm; *lateral sepals* ovate-lanceolate, acute, suberect, middle margin minutely glandular-pubescent, 0.9–1.2 × 0.45–0.5cm. *Petals* oblong, subacute, reflexed, 6–9 × 1–2mm. *Lip* 3-lobed, spurred, shortly clawed at base, suborbicular to broadly obcordate in outline, 1.2–1.6 × 1–1.9cm (when spread); lateral lobes large, ovate, margins fimbriate to crenulate, 0.8–1.5 × 0.5–0.8cm; mid-lobe oblong, margins entire, 0.6–1 × 0.15–0.22cm; spur variable, funnel shaped, slender, geniculate, subclavate, 1.8–3.3cm long. *Column* broad, 2–4mm tall; anther locules broad, divaricate; staminodes globose, tuberculate; pollinia ovate; caudicle incurved;

viscidium minute, globose; stigmas 2, subcylindric to clavate, 3–4mm long. Fruit ovoid, ribbed, 1.5–2 × 0.3–0.4cm.

Bhutan: C – Tongsa district (Mangde Chu, Shemgang); **Darjeeling** (Kurseong, Mongpu, Simsibong, SW of Pul Bazar, NE of Siligori, Takdah); **Sikkim** (Nanga, Tendong). In tropical valleys and open woodland; 610–1520m. Fl. September–October.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China, Thailand, Laos, Cambodia, Vietnam, Japan, Taiwan, Malaysia and the Philippines.

ETYMOLOGY. From the Latin *dentatus* (toothed) in reference to the lip margin.

NOTE. King & Pantling (1898) described a spurless variety of this species in which the flowers have an entire, lanceolate lip and are probably peloric.

3. **H. furcifera** Lindl., Gen. Sp. Orchid. Pl.: 319 (1835). Type: India, Mussooree, *Royle* s.n. (holo. K-LINDL!).

Habenaria hamigera Griff. in Calcutta J. Nat. Hist. 4: 380, t.20 (1844). Type: E Bengal (Bangladesh), *Griffith* 5313 (holo. K!).

H. ovalifolia Wight, Icon. Pl. Ind. Orient. 5: 13, t.1708 (1851). Types: India, Malabar, *Wight* 3016 (syn. K!); India, Anamally Hills, *Wight* 3017 (syn. K!).

H. tenuicornis Wall. ex Hook. f., Fl. Brit. India 6(1): 149 (1890), nom. in syn.

Plant erect, 40–60cm tall; *tuber* fusiform, 2.5–4.5 × 1–1.4cm. *Stem* glabrous, bracteate above leaves; basal sheaths overlapping, tubular, 2–3cm long; stem bracts small, lanceolate, acuminate, 1.5–2 × 0.2–0.3cm. *Leaves* 3–5, clustered in basal third, oblong-ovate to ovate-elliptic, acute, shortly petiolate, sheathing, 6–17 × 2.8–5.5cm; petiole 0.5–1cm long; sheaths 1.5–2cm long. *Inflorescence* laxly many-flowered; rachis glabrous, 14–28cm long; floral bracts lanceolate, acuminate, becoming smaller up rachis, margins minutely ciliate, 0.7–2 × 0.1–0.5cm. *Flowers* 0.7–1cm long, uniformly green; *pedicel and ovary* 0.7–1.2cm long. *Dorsal sepal* ovate-lanceolate, hooded, obtuse, 3.5–4 × 2–3.5mm; *lateral sepals* lanceolate, acute, reflexed to spreading, 3.5–4 × 1.4–1.5mm. *Petals* erect, oblong, obtuse, forming a hood with the dorsal sepal, 1-veined, 3–4 × 1–1.8mm. *Lip* 3-lobed, spurred, shortly clawed; lateral lobes filiform, 6mm long; mid-lobe linear, shorter and broader than the lateral lobes, 4.5–5mm long; spur slender, apex involute, 1.2–1.4cm long. *Column* stout, c.1.5mm tall; anther locules convergent; pollinia ovoid, falcate; caudicle slender; viscidium oblong; staminodes large, oblong; stigmas 2, elliptic. *Fruit* ovoid, sessile, ridged, 7–9 × 3–5mm.

Darjeeling (Gareednura, near Lohagarhi, Mim); **Sikkim** (Tashiding). 610–910m. Fl. July–August; Fr. November.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China and Thailand.

ETYMOLOGY. From the Latin *furcatus* (forked) and *-fer* (carrying) in reference to the forked lip.

NOTE. Pradhan (1976) discussed the possibility that H. *ovalifolia* was conspecific with H. *furcifera*. We have examined the type material of both species and agree with this.

4. **H. malleifera** Hook. f., Fl. Brit. India 6(1): 143 (1890). Types: India, Darjeeling, Senadah (Sonada), *King* s.n. (syn. CAL); India, Khasia Hills, *Lobb* s.n. (syn. K-LINDL!, isosyn. K!); India, Khasia, Myrung, *Hooker & Thomson* 257 (syn. K-LINDL!, isosyn. K!).

Habenaria furfuracea Hook. f., Fl. Brit. India 6(1): 144 (1890). Type: India, Khasia, Nunklow, *Hooker & Thomson* 1798 (holo. K!).

Plant erect, 30–80cm tall; *tuber* globose-fusiform, 1–1.8 × 1–1.8cm; roots pubescent. *Stem* stout, scurfy, leaves clustered on lower third of stem, bracteate above; basal sheaths widely tubular, 3–5.5cm long; stem bracts broadly lanceolate to lanceolate, acuminate, 3–4 × 1.7–0.5cm. *Leaves* 4, broadly elliptic to oblanceolate, acute, petiolate, sheathing at base, 7–20 × 2.5–6.5cm; petiole variable, 1–4cm long; sheaths 2–3cm long. *Inflorescence* laxly many-flowered; rachis scurfy, 8–21cm long; floral bracts lanceolate, acuminate, margins minutely pubescent, 1.3–1.9 × 0.3–0.5cm. *Flowers* 1.3–2cm long, uniformly greenish; pedicel and ovary long, minutely scurfy, pubescent on ridges, 1.8–2.1cm long. *Dorsal sepal* orbicular, hooded, 6 × 4.5mm; *lateral sepals* reflexed, triangular-oblong, obtuse, falcate, lower margin gibbous, 6 × 4.5mm. *Petals* small, triangular, gibbous, 1-veined, 2–3 × 1–2mm. *Lip* 3-lobed, spurred; lateral lobes filiform, spreading, 12–15 × 0.8–1.2mm; mid-lobe filiform, 10–11 × 0.2–0.5mm; *spur* narrow, apex abruptly clavate-globose, curved-geniculate, 1–1.4cm long. *Column* 2.8–3.2mm tall; staminodes adnate to anther locules; anther locules recumbent, curved, 4.5–5mm long; pollinia clavate; caudicles very long, filiform, 3–3.5mm long; viscidium minute, globose; rostellum obscure; stigmas 2, spherical.

Darjeeling (Sitong, Sonada, Sureil). 1520–1830m. Fl. August–September.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Latin *malleus* (a hammer) and *-fer* (to carry), probably a reference to the appearance of the lateral sepals.
NOTES. Seidenfaden (1977a) referred some Pantling specimens to H. *reflexa*, but noted that the material was poor. We have carefully examined specimens of H. *malleifera* and H. *reflexa*, including the Pantling ones, and find it hard to justify their separation. It is worth noting that part of the type collection of H. *malleifera* is from Sonada, close to where the Pantling plants were found. This problem can only be resolved with field study, but we feel that the Pantling material is closer to H. *malleifera* than to H. *reflexa* and conclude that the latter does not occur in our area.

5. **H. marginata** Colebrooke in Hook., Exot. Fl. 2: t.136 (1825). Type: India, icon. Colebrooke 179 (holo. K!).
Platanthera promensis Lindl. in Wall. Cat.: 7033 (1832), nom. nud.
P. marginata Lindl. in Wall. Cat.: 7038 (1832), nom. nud.

Habenaria promensis Lindl., Gen. Sp. Orchid. Pl.: 320 (1835). Type: Myanmar, Mt. Prome, coll. *Wallich* Wall. Cat. 7033 (holo. K-LINDL!, iso. K-W!).
H. *flavescens* Hook. f., Fl. Brit. India 6(1): 150 (1890). Type: India, Concan, *Law* 298 (holo. K-LINDL!).
H. *aurantiaca* Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 418 (1925). Type from Thailand.
H. *marginata* var. *fusifera* (Hook. f.) Santapau & Kapadia in J. Bombay Nat. Hist. Soc. 56(2): 199 (1959).
H. *marginata* var. *flavescens* (Hook. f.) Santapau & Kapadia, *loc. cit.* (1959).

Plant erect, 7–21cm tall; *tubers* 2, elongate, subcylindric, 1.9–2 × 0.6–1cm; *roots* fleshy, whitish. *Stem* glabrous, with leaves clustered towards base, bracteate above; stem bracts 2 or 3, lanceolate-linear, sheathing, margins minutely ciliate, 1.5–2.5 × 0.2–0.6cm. *Leaves* 3 or 4, spreading, elliptic, entire, glabrous, with a distinct semi-transparent border, sheathing at base, 3–7.5 × 1.1–2.5cm; sheaths 1–1.5cm long. *Inflorescence* conical, subdensely many-flowered; rachis 4–10cm long; floral bracts linear-lanceolate, acuminate, 0.8–1.5 × 0.15–0.2cm. *Flowers* scentless, 0.9–1.3cm long; sepals green, petals yellow, lip yellow, spur green; pedicel and ovary glabrous, 1–1.2cm long. *Dorsal sepal* broadly ovate, acute, 3-veined, hooded, 5–5.2 × 3.5–4mm; *lateral sepals* lanceolate, acute, 5-veined, 5–6 × 1.8–2.5mm. *Petals* lanceolate, acute, falcate, 1-veined, forming a hood with the dorsal sepal, 5–6 × 1.5–2.2mm. *Lip* 3-lobed, spurred; lateral lobes linear-lanceolate, acuminate, 0.5–1cm long; mid-lobe linear, obtuse, 0.5–1cm long; *spur* compressed, clavate, 0.9–1.1cm long. *Column* 1–1.2mm tall; anther locules large, clavate; stigmas 2, short to medium in length.

Bhutan: C – Tashigang district (Tashi Yangtsi Dzong). On open sandy grassland; 1680–1770m. Fl. August–September.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China and Thailand.
ETYMOLOGY. From the Latin *marginatus* (margined) in reference to the white to semi-transparent border of the leaves.

6. H. pantlingiana Kränzlin, Orchid. Gen. Sp. 1: 892 (1901). Type: India, Sikkim, *Pantling* 415 (holo. K!, iso. BM! W!).

Habenaria stenopetala var. *polytricha* Hook. f. in Ann. Roy. Bot. Gard. (Calcutta) 5: 64, t.96 (1895). Types: India, Sikkim, *Hooker* 358 (syn. K-LINDL!); Naga Hills, *Prain* (syn. K).

H. longitentaculata Hayata, Icon. Pl. Formos. 4: 466 (1914). Type from Taiwan.

H. cirrhifera Ohwi in Acta Phytotax. Geobot. 1: 141 (1932). Type from Japan.

H. polytricha (Hook. f.) Pradhan, Indian Orch.: Guide Identif. Cult. 1: 68 (1976).

H. seshagiriana A.N. Rao in J. Econ. Taxon. Bot. 6(1): 223 (1985), nom. alt.

H. polytrichoides Averyanov in Bot. Zhurn. (Moscow & Leningrad) 73(3): 432 (1988), nom. alt

Plant erect; *tuber* ovoid, 1.5–2.2 × 1.5–1.9cm. *Stem* thick, bracteate above leaves; basal sheaths leafy, linear-lanceolate to lanceolate, acute, 4–4.5 × 0.4–1.3cm; stem bracts tubular, distant, 3–5cm long. *Leaves* 5–7 (mainly on upper part of stem), ovate-elliptic, acute to acuminate, narrowed to sheathing base, 6.5–17 × 2.5–4.8cm; sheaths 2–2.5cm long. *Inflorescence* short, densely many-flowered; rachis 6–9cm long; floral bracts narrowly linear-lanceolate, caudate, 1.6–2.1 × 0.2–0.25cm. *Flowers* sweetly fragrant, 1.3–1.6cm long, uniformly pale green to yellow-green, pollinia orange-yellow; pedicel and ovary glabrous, 2–2.6cm long. *Dorsal sepal* linear-lanceolate, long-caudate, base gibbous, 1-veined, 2.4–2.5 × 0.4–0.5mm (at base); *lateral sepals* ovate-lanceolate, long-caudate, spreading, 1.5–1.9 × 0.4–0.5cm (at base). *Petals* 2-lobed, filiform, long-caudate, segments divergent, flexuose, 15–16 × 0.2–0.3mm. *Lip* 3-lobed, spurred, 1.5–1.8cm long; lateral lobes long-linear, 1.5–1.8cm long; mid-lobe long-linear, 1.5–1.8cm long; spur narrowly cylindric, 1.7cm long. *Column* stout, 1.8–2mm tall. *Fruit* erect, cylindric-ovoid, shortly stalked, 1.5–1.7 × 0.5–0.7cm; stalk 0.7–1.3mm.

Darjeeling (unlocalised *Gamble* specimen); **Sikkim** (Chunthang, Nanga). In cultivated potato field; 1520–1830m. Fl. July–August; Fr. August.

GENERAL DISTRIBUTION. NE India, China and Vietnam.

ETYMOLOGY. Named in honour of Robert Pantling (1856–1910), Curator of the Royal Botanic Garden, Calcutta who contributed greatly to our knowledge of the orchids of Sikkim.

NOTE. Seidenfaden (1995a) clarified the taxonomy of this species.

7. H. pectinata (J.E. Smith) D. Don, Prodr. Fl. Nepal: 24 (1825). Type: Nepal, Suembu, *Buchanan-Hamilton* s.n. (holo. LINN! Herb. no. 1381.22.1).

Orchis pectinata sensu J.E. Smith., Exot. Bot. 2: 77, t.99 (1806), non Thunberg (1794).

Habenaria gerardiana Lindl. in Wall. Cat.: 7031 (1832), nom. nud.

H. ensifolia Lindl. Gen. Sp. Orchid. Pl.: 321 (1835). Type: Nepal, Gossainthan, *Wallich's collectors* Wall. Cat. 7030 p.p. (holo. K-LINDL!).

H. pectinata subsp. *ensifolia* Soó in Ann. Hist.-Nat. Mus. Natl. Hung. 26: 373 (1929).

Plant erect; *tuber* fusiform, 2–3.5 × 0.8–1cm; *roots* filiform. *Stem* leafy, 22–45cm long; basal sheaths tubular, overlapping, 1.5–4.5cm long. *Leaves* 6–8, distant along stem, narrowly lanceolate-ensiform to lanceolate, acute to acuminate, sessile, shortly sheathing at base, 5–15 × 0.5–3.4cm; sheaths clasping, 0.5–4.5cm long. *Inflorescence* subdensely 7- to many-flowered; rachis glabrous, 6–20cm long; floral bracts leafy, lanceolate, acuminate, 5-veined, 2–5 × 0.4–1.1cm. *Flowers* 2–3cm across; sepals and petals green, lip greenish-white; pedicel and ovary glabrous, 1.5–2.3cm long. *Dorsal sepal* erect, ovate-lanceolate, acute, 5-veined, 1.5–2.2 × 0.4–0.6cm; *lateral sepals* spreading, ovate-lanceolate, oblique, acute to acuminate, 1.6–1.8 × 0.55–0.6cm. *Petals* erect, oblong-lanceolate, acute, 1.5–1.8 × 0.3–0.4cm. *Lip* 3-lobed, shortly clawed, spurred; claw 2.5–5mm long; lateral lobes lacinate-pectinate, filiform, 1.3–2 × 0.5–1cm; mid-lobe linear-oblong, acuminate, 1.4–2cm long; spur pendent, clavate, straight, curved or sigmoid, 1.5–2.9cm long. *Column* stout, 2.5–3.5mm long; anther locules convergent, 4 × 1.3mm; pollinia elliptic; caudicle filiform, curved; viscidia minute, discoid; stigmatic lobes linear, divergent, 0.9–1.2cm long.

Sikkim (Chunthang, Lachung, near Pemayangtse). 1520–2740m. Fl. June–October.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, NE India and China.

ETYMOLOGY. From the Latin *pectinatus* (comb-like) in reference to the margins of the lateral lobes of the lip.

NOTES. *H. pectinata* was reported from Sikkim by Pradhan (1976), Hara, Stearn & Williams (1978) and Renz (1984). *H. pectinata* is closely related to *H. ensifolia* and there has been considerable confusion between them over the years. Banerji & Pradhan (1984) considered that they should be retained as distinct species.

H. ensifolia was first described by Lindley in 1835. Hooker (1890) noted that Lindley had confused *H. pectinata* with *H arietina* (Lindley had actually described *H. arietina* under his description of *H. pectinata*). When, in this same section, he described a new species, *H. ensifolia*, Lindley selected a plant from a Wallich collection (7030 *p.p.* K-LINDL, part of the collection used by Don in 1825 for his *H. intermedia*) as the type. *H. intermedia* Don is closely related to *H. arietina* Hook. f. (both have glandular-pubescent petals) and it is possible that this caused Lindley to believe (having already confused *H. arietina* with *H. pectinata*) that his *H. ensifolia* was a distinct species. Hooker (1890) recognised this confusion, examined the type material of *H. pectinata* (which is a Buchanan-Hamilton collection at LINN) and treated *H. ensifolia* as conspecific with *H. pectinata*.

Banerji & Pradhan (1984) and Chowdhery (1998) distinguished the two species on the basis of spur length, *H. pectinata* having a spur exceeding the ovary and *H. ensifolia* with a spur shorter than the ovary. The drawing of *H. pectinata* associated with the protologue, shows a short stumpy spur described as being slightly longer than 'the germen'. Our examination of this feature shows it to be very variable. There are many specimens labelled as *H. pectinata* with a spur much shorter than the ovary and measuring the spur length does not assist either. We believe that this is a variable species across its distribution range and can find no justification in retaining *H. ensifolia* as distinct.

Having examined a large number of Himalayan plants we believe that there are three groups of plants in the region. The *H. pectinata* group which has glabrous petals and a short, clawed lip base; the *H. arietina* group which has linear-lanceolate leaves, glandular-pubescent petals with a gibbous base and upturned, linear stigmatic lobes; and the *H. intermedia* group which has ovate-elliptic leaves, glandular-pubescent petals with flat bases and longer, hastate, projecting stigmatic lobes. From our studies we believe that *H. limprichtii* Schltr., from China, is closely related to, and possible conspecific with, *H. intermedia* but we have not been able to locate the type material.

8. **H. plantaginea** Lindl., Gen. Sp. Orchid. Pl.: 323 (1835). Types: India, Tinevelly, coll. *Rottler* Wall. Cat. 7053A (syn. K-W!, isosyn. K!); India, Travancore, coll. *Heyne* Wall. Cat. 7053B (syn. K-LINDL!, isosyn. K-W!); India, Monghir, coll. *Buchanan-Hamilton* Wall. Cat. 7053C (syn. K-LINDL!, isosyn. K-W!).

Gymnadenia plantaginea Lindl. in Wall. Cat.: 7053 (1832), *nom. nud.*

Orchis tenuis Rottler in Wall. Cat.: 7053A (1832), *nom. nud.*

Plant erect, 19–40cm tall; *tuber* ovoid-globose, 1.5–2 × 0.8–1.2cm. *Stem* glabrous, bracteate, 15–30cm tall; stem bracts many, distant, lanceolate, acuminate, 1.2–3 × 0.2–0.7cm. *Leaves* 3–7, sub-basal, clustered, elliptic-oblong to oblong-lanceolate, subacute to acute, subsessile, sheathing at base, 6–9.5 × 1.6–3cm; sheaths clasping, 1.2cm long. *Inflorescence* laxly 5- to 9-flowered; rachis glabrous, 2–7cm long; floral bracts lanceolate, acuminate, largest towards base of stem, margins setaceous, 5–9 × 1.8–2mm. *Flowers* faintly fragrant, 1–1.6cm long; sepals white, tinged with green, petals and lip white; pedicel and ovary curved, ridged, beaked, 1.2–1.8cm long. *Dorsal sepal* ovate-oblong, acute, 3-veined, 4–5 × 2–2.5mm; *lateral sepals* oblong, acute, falcate, spreading, 3-veined, 5–7 × 2–3mm. *Petals* narrowly lanceolate, acute, forming hood with dorsal sepal, 1-veined, margins irregularly denticulate, 3–4.5 × 1–1.2mm. *Lip* 3-lobed, broad, spurred, clawed at base, suborbicular to flabelliform, surface glandular-pubescent, 0.7–1.6 × 0.6–1.5cm; lateral lobes semi-ovate, entire to denticulate, 5–8 × 2.5–4mm; mid-lobe linear-oblong, obtuse, 3–5 × 0.6–0.8mm; *spur* long-filiform, pendent, 1.8–2.4cm long. *Column* 1–1.2mm long; stigmatic lobes long, projecting, elliptic, clavate; anther locules stalked. *Fruit* ridged, shortly stalked, suberect, 0.8–1.3cm long.

Terai (unlocalised *Hooker* specimen). 1000–2500m. Fl. August–October.

GENERAL DISTRIBUTION. Sri Lanka and throughout India.

ETYMOLOGY. From the Latin *plantagineus* after *Plantago* (Plantaginaceae), referring to the European plantain which has similar leaves.

9. **H. stenopetala** Lindl., Gen. Sp. Orchid. Pl.: 319 (1835). Type: India, Kashmir, *Royle* s.n. (holo. K-LINDL!).

Habenaria delessertiana Kränzlin in Annuaire Conserv. Jard. Bot. Genève 1: 108 (1897). Type from the Philippines.

H. linearipetala Hayata, Icon. Pl. Formos. 4: 126, t.23 (1914). Type from Taiwan.

H. sutepensis Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 420 (1925). Type from Thailand.

H. amanoana Ohwi in J. Jap. Bot. 31(5): 136 (1956). Type from the Ryukyus.

Plant erect; *tuber* fusiform. *Stem* thick, bracteate above the leaves, 40–80cm tall; basal sheaths distant, tubular, subacute, 2–4.5cm long; stem bracts lanceolate, acute, 3–5.5 × 0.5–1.4cm. *Leaves* 5–8, borne towards upper part of stem, ovate-lanceolate, acuminate, shortly petiolate and sheathing at base, 6–16 × 2.2–3.2cm; petiole channelled, 0.5–1.2cm. *Inflorescence* densely many-flowered; rachis variable, glabrous, 5–16cm long; floral bracts membranous, narrowly lanceolate, acuminate, 3-veined, 1.3–1.5 × 0.2–0.3cm. *Flowers* 1–2cm across; sepals and petals white, greenish at apex, lip whitish-yellow; pedicel and ovary long, 1–1.8cm long. *Dorsal sepal* ovate-lanceolate, acuminate, 3-veined, 5–9 × 2.5–4.5mm; *lateral sepals* ovate-lanceolate, acuminate to subcaudate, weakly falcate, 3-veined, 0.9–1.1 × 0.45–5cm. *Petals* linear, acute, erect, unequally bifid from base, 5–8 × 0.1–0.8mm, short arm of petal 2–3mm long. *Lip* 3-lobed, spurred, shortly clawed at base, 0.9–1.1cm long; lateral lobes shorter then the mid-lobe, narrowly linear-lanceolate, acute, 4–6mm long; mid-lobe linear-lanceolate, subacute, 7–9mm long; *spur* filiform, obtuse, 10–14 × 0.7–0.8mm. *Column* 3–5mm long; anther locules convergent, curved forward at base, 3–4mm long; pollinia 0.8mm long; caudicle filiform, 3mm long; viscidium minute, globose; staminode ovate, rugose, 0.8–1mm long; stigmas 2, oblong, projecting.

Bhutan: S – Sankosh district (above Daga Dzong); **C** – Tongsa district (below Tama); **Darjeeling** (Mongpu, Sureil); **Sikkim** (Rinchingpong). In dry, open *Quercus* forest, beside roads; 300–2050m. Fl. August–October.

GENERAL DISTRIBUTION. Nepal, NE India and China.

ETYMOLOGY. From the Greek *stenos* (slender) and *petalon* (petal).

NOTES. Seidenfaden (1995a) resolved the confusion between this species and the closely related *H. pantlingiana*. The Tama specimen (*Broad*, s.n., E) is probably a peloric form of this species; it was initially thought by Renz (pers comm.) to be an undescribed species.

10. **H. trichosantha** Wall. ex Lindl. in Gen. Sp. Orchid. Pl.: 324 (1835). Type: Myanmar (Burma), Taong Dong, on River Mytinge, coll. *Wallich* Wall. Cat. 7028 (holo. K-LINDL!, iso. K-W!).

H. trichosantha Wall. in Wall. Cat.: 7028 (1832), *nom. nud.*

Plant erect, 21–60cm tall; *tuber* globose, 1–2 × 0.5–1.2cm. *Stem* leafy, bracteate above the leaves, 26–50 × 0.4–0.6cm; basal sheaths overlapping, tubular, 1–1.5cm long, mouth wide; stem bracts linear-lanceolate, acuminate, 2–3.5 × 0.3–0.4cm. *Leaves* 2–3(–4), borne towards base of stem, distant, lanceolate-ovate, acute to apiculate, sessile, sheathing at base, 5–11 × 1.6–2.8cm; sheaths tubular, clasping, 2–2.2cm long. *Inflorescence* terminal, racemose, subdensely 6- to 9-flowered; rachis glabrous, 5cm long; floral bracts lanceolate, acuminate-caudate, margins minutely pubescent, 1-veined, 1.6–1.7 × 0.3–0.4cm. *Flowers* 1.5–2cm across, uniformly white; pedicel and ovary 2–2.8cm long. *Dorsal sepal* ovate-oblong, acute-apiculate, upper margins minutely glanduar-pubescent, 5-veined (central 3 strong, outer 2 weak), 1–1.1 × 0.35–0.45cm; *lateral sepals* ovate-oblong to lanceolate, acuminate, 5-veined, reflexed, 1.1–1.3 × 0.4–0.65cm. *Petals* linear-falcate, acuminate, margins entire to serrulate, 1-veined, 0.8–1.1 × 0.13–0.15cm. *Lip* 3-lobed, shortly clawed at base, spurred; claw 1.5–3mm long; lateral lobes lacinate, filiform, 0.9–1.2cm long; mid-lobe linear-lanceolate, subacute, 0.7–1.1cm long; spur curved, clavate, 2.3–5cm long. *Column* 2–3mm long; stigma short, globose. *Fruit* ovoid, ribbed, sessile, 1.7 × 0.6cm.

Bhutan: C – Mongar district (Manjibi, Mongar). On sandy soils under *Pinus roxburghii* forest and in deciduous oak forest; 1680–1830m. Fl. July–August.

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. From the Greek *trichon* (small hair) and *anthos* (flower) in reference to the finely lacinate lateral lobes of the lip.

Section **Diphyllae** Kränzlin in Engler, Bot. Jahrb. Syst. 16: 56, 147 (1892).

11. **H. aitchisonii** Rchb. f. apud Aitchison in Trans. Linn. Soc. London ser.2, 3: 113 (1888). Type: Pakistan, Kuram District, Darban Valley, Aitchison 413 (holo. K!).

Habenaria brachyphylla Aitchison in J. Linn. Soc., Bot. 19: 188 (1882).

H. diceras Schltr. in Notes Roy. Bot. Gard. Edinburgh 5: 101, t.78 (1912). Type: China, Lichiang Range, *Forrest* 3074 (holo. E!).

H. bihamata Kränzlin in Feddes Repert. Spec. Nov. Regni Veg. 17: 106 (1921). Type: China, Yunnan, Peyentsin, S. Tén s.n. (holo. B).

H. pubicaulis Schltr. in Acta Horti Gothob. 1: 139 (1924). Type: China, Szechuan (Sichuan), H. Smith 3858 (holo. UPS).

H. diceras var. *pubicaulis* (Schltr.) Soó in Ann. Hist.-Nat. Mus. Natl. Hung. 26: 370 (1929).

Plant 10–40cm tall; *tubers* cylindric, 1.5–4.5 × 0.5–1cm. *Leaves* 2, basal, appressed to ground, subopposite, orbicular to broadly ovate, acute, sessile, thick, 5–8.5 × 4.5–8.8cm. *Stem* softly glandular-pubescent, bracteate above the leaves; stem bracts appressed, lanceolate, acute, 1.1 × 0.3cm; peduncle 6–20cm long. *Inflorescence* subsecund, subdensely many-flowered; rachis 3.5–20cm long; floral bracts lanceolate, acute, 6–7 × 1.5–2mm. *Flowers* erect, appressed to rachis, 5–7mm long, uniformly green to yellowish-green; pedicel and ovary 5–9mm long. *Dorsal sepal* ovate, acute, concave, erect, forming a hood with petals, 1-veined, 4–5 × 2.5–3mm; *lateral sepals* obliquely ovate-lanceolate, acute, 4–5 × 2–3mm. *Petals* falcately oblong-lanceolate, 1-veined, 3.5–5 × 1–2mm. *Lip* 3-lobed, spurred, 6–7mm long; lateral lobes filiform, spreading, 4–5 × 0.1–0.2mm; mid-lobe linear, straight, deflexed, 4.5–5 × 0.5–0.7mm; spur inflated towards apex, 0.7–1cm long. *Column* 1.3–1.6mm long; stigmas 2, conjoined, clavate-obovoid, apex bifid; anther c.1mm long. *Fruit* fusiform, curved, glabrous, 0.9–1.2 × 0.2–0.3cm.

Bhutan: N – Upper Mo Chu district (Laya); **Sikkim** (Lachen); **Chumbi** (Trakarpo). In open *Juniperus*/*Larix* forest, on sandstone, under *Rhododendron lepidotum*; 3050–3950m. Fl. July–September.

GENERAL DISTRIBUTION. NE India and China.

ETYMOLOGY. Named after James Aitchison (1836–1898) who collected plants in India and Afghanistan and served in the Bengal Medical Service. He collected the type material of this species.

12. **H. diphylla** Dalzell in Hooker's J. Bot. Kew Gard. Misc. 2: 262 (1850). Type: India, Concan, *Dalzell* s.n. (holo. K-LINDL!, iso. K!).

var. **josephi** N. Pearce & P.J. Cribb in Edinb. J. Bot. 58(1): 114 (2001). Type: India, Sikkim, *Hooker* 253 (holo. K-LINDL!, iso. K! Herb. Ind. Or. no. 42).
Habenaria josephi Rchb. f. in Trans. Linn. Soc. London ser.2, 3: 114 (1888).
Habenaria aitchisonii var. *josephi* (Rchb. f.) Hook. f., Fl. Brit. India 6(1): 152 (1890). Types: India, Sikkim, *Hooker* 253 (syn. K! ('42')); China (Xizang), Chumbi, Ling-moo-tong, *King's collector* 22 (syn. K!).
H. clarkei Kränzlin in Bot. Jahrb. Syst. 16: 215 (1893). Type: India, Sikkim, *Hooker* '42' (holo. B†, iso. K! LE?).

Plant 5–20cm tall; *tuber* ovoid-fusiform, 1–1.5 × 0.7–0.9cm. *Stem* bearing leaves in lower quarter, ebracteate above; basal sheath tubular, 0.6–1cm long. *Leaves* 2, opposite, broadly ovate-orbicular to weakly cordate, apiculate, sessile, sheathing at base, margins translucent, 1.5–2.5 × 1.7–2.5cm; sheaths 0.5–1cm long. *Inflorescence* laxly to subdensely 4- to 6-flowered; rachis minutely glandular-pubescent, 1.5–4cm long; floral bracts narrowly lanceolate, acuminate, margins glandular-pubescent, 5-veined, 1–1.4 × 0.15–0.25cm. *Flowers* 5–9mm long, uniformly green; pedicel and ovary glandular-pubescent on ribs, curved, 0.6–1.1cm long. *Dorsal sepal* ovate, acute, forming hood with the petals, 5.5–6 × 2.5–3mm; *lateral sepals* ovate, acute, 3-veined, reflexed to spreading, 5–7 × 2.5–2.8mm. *Petals* triangular-lanceolate, acuminate, base broad, 5–6 × 2–2.5mm. *Lip* 3-lobed, shortly clawed, spurred; lateral lobes linear, apex recurved-coiled, 6–9 × 0.5–0.8mm; mid-lobe linear, 4.5–5.5 × 0.5–0.6mm; spur curved, clavate, 0.7–1.5 × 0.1–0.2cm. *Column* stout, 1–1.5mm tall; anther locules parallel; pollinia globose-ovoid; caudicle short, stout; viscidia large, discoid; staminode elongate; stigmas 2, united above mouth of spur. **Fig. 41.**

Bhutan: C – Thimphu district (Sharna to Tremo La); **N** – Upper Mo Chu (Laya, Lingshi, E bank of Tharizam Chu), Upper Pho Chu (Gyophu La), Upper Bumthang Chu (Chamka, Marlung) and Upper Kulong Chu (Me La) districts; **Sikkim** (Lachen Valley, Thanggu); **Chumbi** (Chomo Lhari, Ling-moo-tong?, Phari Dzong). On open, grassy subalpine hillsides, in *Betula utilis* forest, among dwarf *Rhododendron* spp., on grassy stream banks; 3660–4880m. Fl. July–September.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named in honour of Joseph Dalton Hooker (1817–1911) who collected the type material.
NOTES. This variety differs from typical *H. diphylla* in that the stem is ebracteate above the leaves whereas in var. *diphylla* there are several bracts above the leaves. It differs from *H. aitchisonii* in having coiled tips to the lateral lobes of the lip.

Kränzlin based his *H. clarkei* upon a Hooker collection (no. '42') from Sikkim. Both *H. josephi* and *H. aitchisonii* var. *josephi* are based on duplicates with the same number. Although Kränzlin's type material has probably been destroyed, from his description of the petals as 2-lobed, and the specimen number, we are confident that *H. clarkei* can be reduced to synonymy as above.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

H. acutifera Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 325 (1835). Type: Myanmar (Burma), Tavoy, coll. *W. Gomez* Wall. Cat. 7045 (holo. K-LINDL!, iso. K-W!).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

H. digitata Lindl., Gen. Sp. Orchid. Pl.: 307 (1835). Type: Bangladesh, Mt. Pandua, coll. *F. De Silva* Wall. Cat. 7063 (holo. K-W!).
Habenaria trinervia Wight, Icon. Pl. Ind. Orient. 5: t.1701 (1851). Type: India, Belgaum, *Law* 57 (holo. K-LINDL!).

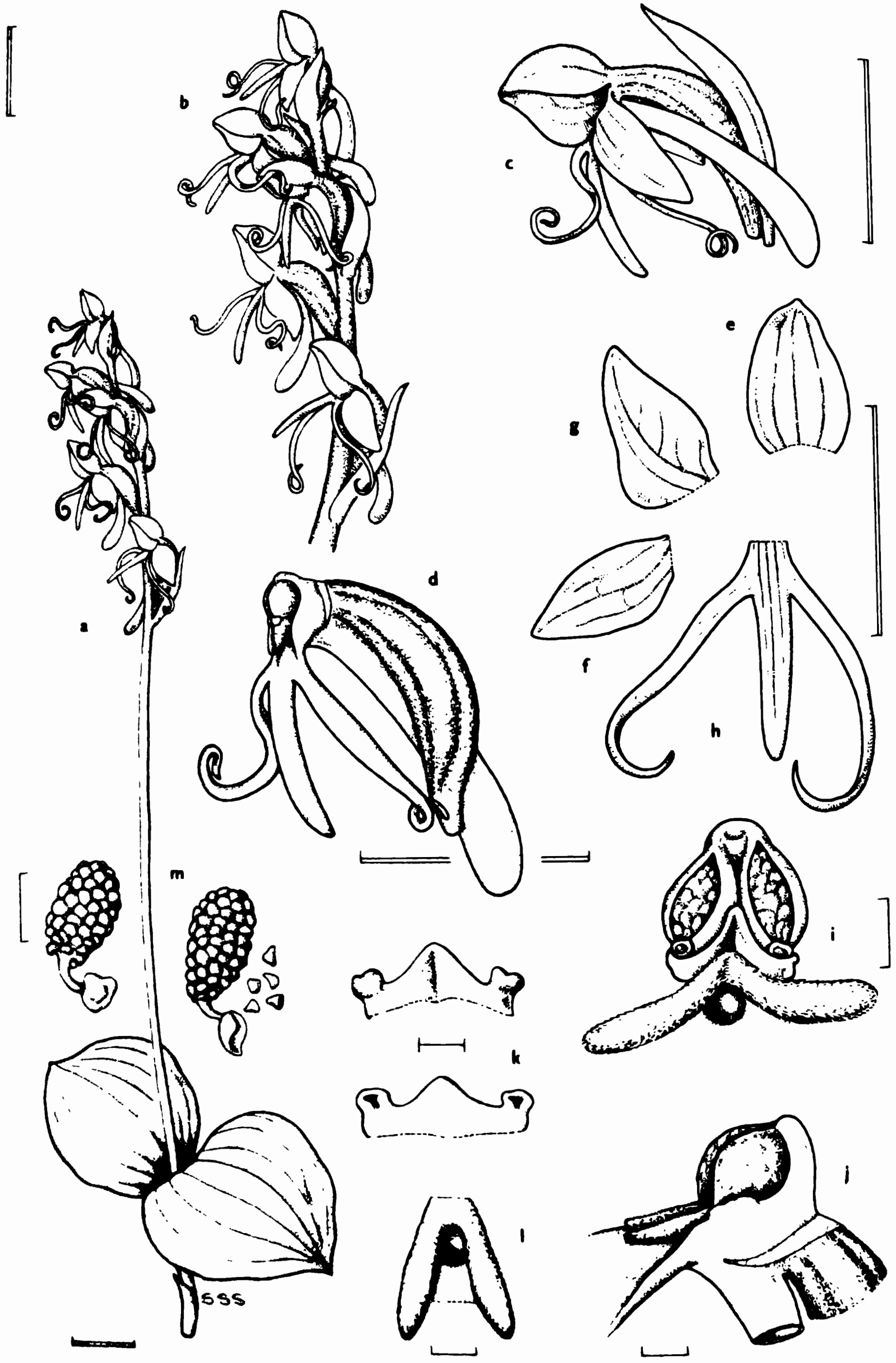


Fig 41 *Habenaria diphylla* var *josephi*: a, habit; b, inflorescence; c, flower; d, lip, column and ovary; e, dorsal sepal, f, lateral sepal; g, petal; h, lip; i, column; j, column (side view); k, rostellum (front and back views); l, stigmas with mouth of spur (detail), m, pollinaria with massulae. Drawn by Susanna Stuart-Smith from *Gould* 1083 (K).

H. graveolens Duthie in Ann. Roy. Bot. Gard. (Calcutta) 9: 178, t.128 (1906). Types: Kashmir, *Falconer* (syn. K); *Mackinnon* 22728 (syn. K); India, Mussoorie, *Duthie* 637 (syn. K); India, Dehra Dun, *Duthie's collector* 24177 (syn. K); Kumaon, *Duthie's collector* 24063 (syn. K).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

H. reflexa Bl., Bijdr.: 403 (1825). Type: Java, *Blume's collector* s.n. (holo. L! Herb. no. 90316256).
Habenaria murtonii Hook. f., Fl. Brit. India 6(1): 144 (1890). Type: Malaysia, Perak, *Scortechini* 552 (syn. K!); Malaysia, Perak, *Murton* 50 (syn. K!).

NOTE. See notes under *H. malleifera* above.

41. **Hemipilia** Lindl.

Plants terrestrial, erect, small to medium-sized; *tuber* small, ovoid to ellipsoid. *Leaf* solitary, basal, prostrate, fleshy. *Inflorescence* terminal, erect, racemose, secund, laxly few- to many-flowered; peduncle 1- to 3-bracteate; floral bracts lanceolate. *Flowers* resupinate, small, showy; purple. *Sepals* and *petals* similar, free, spreading. *Lip* 3-lobed to entire, spurred, ecallose or with 2 low basal ridges; *spur* cylindric to fusiform. *Column* erect, subconnate with base of lip; anther locules subhorizontal, adnate and diverging at base; pollinia 2, clavate, granular; viscidia enclosed in incurved apex of rostellar arms; staminodes 2, sessile; rostellum 3-lobed, lateral lobes diverging, mid-lobe projecting forwards and upwards; stigma arms short, incurved.

The genus *Hemipilia* was established in 1835 by John Lindley in his *Genera and Species of Orchidaceous Plants*. The genus comprises about 10 species distributed in the Himalayas, China and Indo-China.

Luo & Chen (1999) demonstrated that the Chinese *H. flabellata* Bureau & Franchet relied on deception to attract pollinators. The bee *Anthophora mangkamensis* was seen carrying pollinia of the orchid, but the low visiting rate and the low fruit set suggested that the orchid relied on the locally common *Ajuga forrestii* Diels (Labiatae) to attract the bees by providing an alternative source of nectar.

TYPE. *Hemipilia cordifolia* Lindl.
ETYMOLOGY. From the Greek *hemi* (half) and *pilos* (felt) in reference to the sparsely hirsute lip of the type species.

1. **H. cordifolia** Lindl., Gen. Sp. Orchid. Pl.: 296 (1835). Type: Nepal, Gossainthan, *Wallich's collectors* Wall. Cat. 7049 (holo. K-LINDL!, iso. K-W! K!).
Platanthera cordifolia Lindl. in Wall. Cat.: 7049 (1832), *nom. nud.*

Plant 14.5–30cm tall; *tuber* cylindric to ovoid, 2.5–3 × 1–4cm. *Stem* erect, bracteate above leaf, 9–16cm tall; stem bracts lanceolate, acuminate, 1.2 × 0.3cm. *Leaf* broadly ovate-cordate, acute, sheathing at base, 3.5–9 × 3.2–5cm; sheaths clasping, 1.5–5cm long. *Inflorescence* secund, laxly to subdensely 8- to many-flowered; rachis glabrous, 5–12cm long; floral bracts ovate to ovate-lanceolate, acute, 6–9 × 2–3mm. *Flowers* 1–1.2cm across, uniformly purple; pedicel and ovary slender, fusiform, 1–1.3cm long. *Dorsal sepal* ovate to ovate-lanceolate, obtuse, 4.5–5 × 2–2.4mm; *lateral sepals* ovate, falcate, obtuse, spreading, 5-veined, 5–5.5 × 3–3.5mm. *Petals* ovate-lanceolate, obtuse, 1-veined, forming a hood with the dorsal sepal, 3–3.2 × 1.5–2mm. *Lip* obscurely and variably 3-lobed, spurred, 7–9 × 3.5–6mm; lateral lobes broad, rounded, reflexed; mid-lobe rounded, margins crenulate; *spur* cylindric, obtuse, horizontal, 0.9–1.1cm long. *Column* broad, 1.5–2.5mm tall; anther locules distant; pollinia obliquely clavate; caudicle curved; rostellum broad, projecting from between the anther locules; stigma arms short. **Fig. 42.**

Bhutan: C – Thimphu district (hill above Thimphu hospital, above Yangchenphug School); **N** – Upper Mo Chu district (Gyengatang). In damp hollows around rocks on eroded, scrub-covered hill, open hillside; 2500–2900m. Fl. July–September.

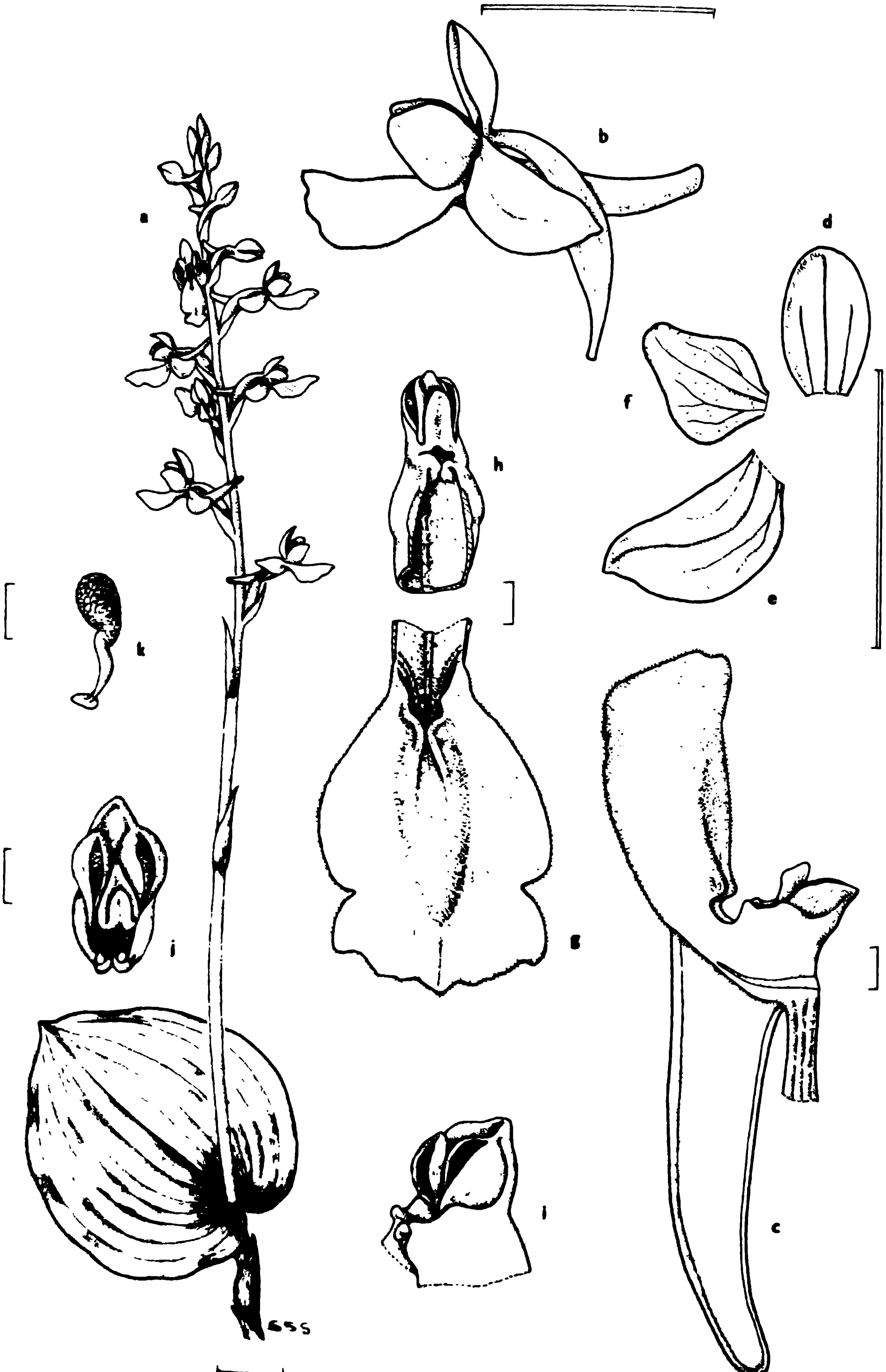


Fig. 42. **Hemipilia cordifolia**: a, habit; b, flower; c, lip, spur and column (side view); d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (front view); i, column (side view); j, anther (detail); k, pollinarium. Drawn by Susanna Stuart-Smith from *Nahaka* s.n. (K).

GENERAL DISTRIBUTION. Nepal, NE India, China and Myanmar.
ETYMOLOGY. From the Latin *cordatus* (heart-shaped) and *-folius* (leaved).

42. Herminium R. Br.

Plants terrestrial, small, glabrous; *tubers* cylindric, undivided. *Stem* with bladeless sheaths at base. *Leaves* single or few. *Inflorescence* terminal, racemose, erect, laxly to densely many-flowered; floral bracts small, lanceolate. *Flowers* small, often spider-like; ovary sessile. *Sepals* subsimilar; *dorsal sepal* free or connivent, hooded; *lateral sepals* spreading. *Petals* smaller than the sepals, forming hood with the dorsal sepal. *Lip* continuous with the column base, spreading to pendent, entire, 2- or 3-lobed, flat, concave or obscurely saccate at the base; ecallose. Column short; anther 2-locular, adnate to the face of the column; anther locules parallel; pollinia 2; caudicles very short; viscidia 2, small to large; staminodes prominent; stigma 2-lobed, convex, clavate; rostellum short.

The genus Herminium was established in 1758 by Linnaeus in his *Opera Vana*. The genus comprises about 50 species distributed in Europe, across to China, Japan and the Indian subcontinent.

Nilsson (1979) studied the pollination of H. *monorchis* in Sweden and found it to be pollinated by Hymenoptera, Chloropidae and Scatopsidae, which are attracted by scent and nectar. Some insects were found to spend time grooming to rid themselves of the pollinia and this behaviour will occasionally result in geitonogamy (fertilisation between neighbouring flowers on the same plant).

TYPE. *Herminium monorchis* (L.) R. Br.; basionym: *Ophrys monorchis* L.
ETYMOLOGY. From the Greek *ermin* (bed-post), probably referring to the shape of the tubers.

Key to species

1. Lip simple 2
+ Lip 3- to 5-lobed 7

2. Leaf 1 3
+ Leaves 2 or more 5

3. Stem lacking bracts above the leaf .... **9. H. monophyllum**
+ Stem with bracts above the leaves 4

4. Leaf orbicular-elliptic, lacking reticulate markings; stem bracts 2; lip not recurved at apex **1. H. angustilabre**
+ Leaf orbicular-cordate, with reticulate markings; stem bract 1; lip recurved at apex **5. H. kalimpongense**

5. Stem with bracts above the leaves .... **11. H. orbiculare**
+ Stem lacking bracts above the leaves 6

6. Lip spurred; lip apex obtuse; flowers pale green to white .... **2. H. duthiei**
+ Lip spurless; lip apex acuminate; flowers green to yellow-green .... **4. H. josephi**

7. Lip 5-lobed .... **13. H. quinquelobum**
+ Lip 3-lobed 8

8. Plant less than 4cm tall .... **12. H. pygmaeum**
+ Plant more than 5cm tall 9

9. Stem lacking bracts above the leaves .... **8. H. macrophyllum**
+ Stem with bracts above the leaves 10

10. Lip obscurely 3-lobed .... **3. H. jaffreyanum**
+ Lip distinctly 3-lobed 11

11. Lateral lobes of lip narrowly triangular; rachis less than 3cm long .... **10. H. monorchis**
+ Lateral lobes of lip filiform; rachis more than 4cm long 12

12. Base of lip with long claw; ovary fusiform .... **6. H. lanceum**
+ Base of lip with short claw; ovary ovoid .... **7. H. mackinnonii**

1. H. angustilabre King & Pantling in J. Asiat. Soc. Bengal 65(2): 131 (1896). Type: India, Sikkim, Lingtu (Lungthung), *Pantling* 375A (holo. CAL, iso. W!).

Plant slender, 7.5–12cm tall. Stem angled, bracteate above the leaf; basal sheaths 2, overlapping, tubular, 1.2–1.4cm long; stem bracts 2, linear-lanceolate, acuminate, 1.3 × 0.2cm. *Leaf* 1, basal, elliptic, obtuse, sessile, 1.7 × 0.5cm. *Inflorescence* subdensely 8- to 12-flowered; rachis glabrous, 1.5–2.5cm long; floral bracts linear-lanceolate, acuminate, 1-veined, 5–8 × 0.8–1.5mm. *Flowers* 4–6mm across, uniformly green; pedicel and ovary glabrous, 2–3mm long. *Dorsal sepal* broadly ovate, acute, concave, recurved, 1-veined, 2–3 × 0.8–1mm; *lateral sepals* narrowly oblong, subacute, 1-veined, deflexed, 2.5–3 × 0.6–0.8mm. *Petals* oblong, subacute, 1-veined, 2.5–2.6 × 0.5–0.8mm. Lip simple, linear, deflexed, subacute, entire, 1-veined, 2.5–3.5mm long. *Column* winged (in lower half), 0.5–0.8mm tall; anther locules distant, parallel; stigmas conjoined.

Sikkim (Lungthung, Singalila Range, Tangkar La). 4000–4330m. Fl. July–August.

GENERAL DISTRIBUTION. NE India and China.

ETYMOLOGY. From the Latin *angusti-* (narrow) and *labrum* (lip).

2. H. duthiei Hook. f., Fl. Brit. India 6(1): 130 (1890). Type: India, W Himalaya, Garhwal, Kuári, *Duthie* 4424 (holo. K!, iso. BM!).

Plant 6–25cm tall; *tuber* ellipsoid to globose, 0.8–1.8 × 0.4–0.8cm. Stem erect, leaves borne in basal third, ebracteate above, 5–14cm long; basal sheath lanceolate-tubular, 1.5–4.5cm long. *Leaves* 2 or 3, linear to oblanceolate, acuminate, sheathing at base, 3–10.5 × 0.4–1.5cm; sheaths 1–2cm long. *Inflorescence* subsecund, subdensely many-flowered; rachis 2.5–8.5cm long; floral bracts minute, lanceolate, acute, 1–1.5mm long. *Flowers* deflexed, 3–5mm across, uniformly pale green to white; pedicel and ovary short, glabrous, 4.5–6mm long. *Dorsal sepal* broadly oblong, obtuse, 3-veined, 2–2.2 × 1–2mm; *lateral sepals* oblong-lanceolate, obtuse, weakly falcate, 1-veined, 2–2.5 × 0.8–1.5mm. *Petals* ovate to ovate-lanceolate, acute, fleshy, 1.8–2.25 × 1–1.2mm. Lip simple, variable, shortly spurred, broadly ovate, ovate-lanceolate, weakly cordate to orbicular-ovate, obtuse, margin entire to subcrenulate, 1.5–2 × 1mm; *spur* short, saccate, 0.5–1mm long. *Column* 0.8–1mm tall; anther locules oblong, parallel; pollinia clavate, sessile, 0.5–0.6mm long; viscidium conical, truncate, horn-like; staminode large, spreading, 0.25–0.3mm; stigmatic processes clavate, large; rostellum linear, erect. *Fruit* ovoid, subsessile, 4–5 × 1.5–1.8cm.

Bhutan: C – Ha (Saga La to Ha), Tongsa (Pele La to Ritang) and Bumthang (Minling) districts; N – Upper Mo Chu district (Gasa). S-facing pastures and boulder-fields; 2490–3660m. Fl. June–July.

GENERAL DISTRIBUTION. NW India, Nepal, NE India.

ETYMOLOGY. Named after John Firminger Duthie (1845–1922), a British botanist who collected the type specimen.

3. H. jaffreyanum King & Pantling in J. Asiat. Soc. Bengal 65(2): 130 (1896). Type: India, Darjeeling, Senchal, *Pantling* 237A (holo. CAL, iso. K! L! W!).

Plant 10–14cm tall; *tuber* ellipsoid to subglobose, 0.8–1.4 × 0.5–0.6cm; *roots* slender. *Stem* sheathed at base, leaves borne in lower half, bracteate above, 6–9.5cm long; basal sheaths 2, overlapping, 1–1.5cm long, mouth wide; stem bracts linear-lanceolate, acuminate, 1.1–1.4 × 0.15–0.2cm. *Leaves* 2, distant, linear-oblong to oblong, acute, sessile, sheathing at base, 7–12 × 0.4–1cm; sheaths 1–2cm long. *Inflorescence* densely many-flowered; rachis glabrous, 4.5–8cm long; floral bracts small, lanceolate, acuminate, margins and surface minutely glandular, 2–3.5 × 0.5–0.7mm. *Flowers* 2–3mm across, uniformly green; pedicel and ovary glabrous, 3–4mm long. *Dorsal sepal* ovate-elliptic, obtuse, erect, 1.6–2 × 0.8mm; *lateral sepals* ovate-elliptic, obtuse, spreading, 1.8–2 × 0.8mm. *Petals* linear-oblong, obtuse, 1-veined, 1.8–2.2 × 0.25mm. *Lip* obscurely 3-lobed, base broad, oblong-triangular, spurless; lateral lobes rounded, small, 0.2mm wide; mid-lobe oblong, tapering to obtuse apex, 1.2mm long. *Column* broad, 0.6mm tall; anther locules parallel, 0.5mm long; pollinia sessile; stigmas united, transversely oblong. *Fruit* ovoid, subsessile, 3–4 × 1.4–1.6mm.

Darjeeling (Senchal); **Sikkim** (Rungbool?, Singalila Range). 2330–3330m. Fl. August.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Probably named after Andrew T. Jaffray (sic), a horticulturist from Madras who played an important role in the introduction of cinchona to Darjeeling.

NOTES. *H. jaffreyanum* is closely related to *H. quinquelobum*. King & Pantling (1898) distinguished them by the 3-lobed lip and sessile pollinia of *H. jaffreyanum* and the 5-lobed lip and short caudicle of *H. quinquelobum*. There is little material available of either of these species, and this is of poor quality; further collections are required to resolve the question as to whether or not they are truly distinct.

4. H. josephi Rchb. f. in Flora 55: 276 (1872). Type: India, Sikkim, *Hooker* 264 (holo. K-LINDL!, iso. K! W!).

Herminium forrestii Schltr. in Notes Roy. Bot. Gard. Edinburgh 5: 96 (1912). Type: China, Yunnan, Lichiang Range, *Forrest* 2590 (holo. E!, iso. K!).

H. suave T. Tang & F.T. Wang in Bull. Fan Mem. Inst. Biol. 7: 131 (1936), *nomen*.

Peristylus forrestii (Schltr.) K.Y. Lang in Acta Phytotax. Sin. 25(6): 454 (1987).

Plant 13–23cm tall; *tuber* globose-ovoid, 1 × 0.7cm; *roots* long, filiform. *Stem* with leaves borne in lower third, ebracteate above, 9–14.5cm long; basal sheaths lanceolate-tubular, obtuse, 3–4cm long, mouth wide. *Leaves* 2 (occasionally 3), subopposite, linear-oblong to oblong-elliptic, subacute to acute, sessile, sheathing at base, 4.5–9 × 0.4–2cm; sheaths 1–1.5cm long. *Inflorescence* densely to subdensely many-flowered; rachis glabrous, 4–8.5cm long; floral bracts small, ovate, subacute, 1–1.8 × 0.5–0.8mm. *Flowers* 5–7mm across, uniformly green to greenish-yellow; pedicel and ovary hooked at apex, 6–7mm long. *Dorsal sepal* broadly ovate-elliptic, obtuse, erect, forming a hood with petals, 3-veined, 2.5–3.2 × 1.8–2mm; *lateral sepals* oblong, subacute, falcate, erect to suberect, 1-veined, 3–5 × 1.2–1.8mm. *Petals* triangular-lanceolate, base broad, subacute, oblique, 2.5–4 × 0.8–2mm. *Lip* simple, large, flat, fleshy, shortly and broadly clawed at base, broadly ovate-lanceolate, acuminate, margins sub-crenulate to entire, 3.5–6 × 3.5–4mm; disc 2-lamellate, lamellae inclined, 2–2.5mm long. *Column* base broad, 1.5mm tall; anther locules converging upwards, 1.5mm long; pollinia ellipsoid; caudicle short; viscidium large, horn-like; staminodes oblong, 0.6mm long; stigmas 2, oblong, obtuse; rostellum ± hastate, 1 × 0.6mm. *Fruit* ovoid, twisted, shortly stalked, 3 × 1.8cm. **Plate 6.**

Bhutan: C – Thimphu district (Motithang, Pajoding, below Pajoding, E of Thimphu); **N** – Upper Mo Chu (Gasa, Laya, Lingshi Dzong), Upper Bumthang Chu (Chamka, Pangotang, Waitang) and Upper Kulong Chu (Me La) districts; **Sikkim** (Chemathang, Chhoptha, Lachen Valley, Lasha Chhu, at foot of Onglathang Glacier, Samiti Lake, above Thanggu); **Chumbi** (Chumbitang, Kaju Gompa, Tangkha Chhu, E of Yatung, between Yatung and Trakarpo). In open grassy clearings in *Picea*/*Abies* forest, in *Betula utilis* forest, in dry peaty soil in juniper forest, on grassy slopes among *Berberis/Potentilla* scrub, on glacial debris; 2890–4500m. Fl. June–September; Fr. August.

GENERAL DISTRIBUTION. Nepal, NE India and China (Yunnan, Xizang).
ETYMOLOGY. Named in honour of Joseph Dalton Hooker (1817–1911) who collected the type material.
NOTES. We have carefully examined specimens of *H. josephi* from the Himalayas and compared them with the type material of *H. forrestii*. The overall morphology of the plants is identical, the differences are merely in the size of the floral parts. We believe that these characters are so variable over the distribution range that it is not possible to justify their continued separation. Wang (1994) treated *H. forrestii* as conspecific with *H. josephi* and we agree with this treatment.

5. **H. kalimpongense** Pradhan, Indian Orch.: Guide Identif. Cult. 2: 680 (1979). Type: India, Kalimpong, *U.C. Pradhan's collector* (holo. Herb. Pradhan).

Plant up to 15cm tall; *tuber* globose to ovoid-globose, 1–1.5 × 1cm. *Stem* short, bracteate above leaf, 0.8–1cm tall; stem bract 1, prominent (just above the leaf). *Leaf* 1, basal, cordate, ± succulent, sessile, finely margined and reticulately marked with dark green, 2–2.5cm wide. *Inflorescence* slender, 3- or 4-flowered; rachis 12–15cm long; floral bracts acute to acuminate, c.1cm long. *Flowers* semi-open; dorsal sepal and petals green, lateral sepals white with a green apex. *Dorsal sepal* concave, ovate, obtuse, 3-veined, 6 × 2mm; *lateral sepals* lanceolate-ovate, acute, 1-veined, 6 × 1mm. *Petals* lanceolate, acute, 1-veined, forming a hood with the dorsal sepal, 6 × 1mm. *Lip* simple, concave, ensiform, apex recurved, acute, 7 × 1.5mm. *Column* short; anther locules clavate, parallel; pollinia ovate-globose; viscidium minute, globose; staminodes large, triangular, recurved at apex, c.3mm long; stigma short, oblong.

Darjeeling (Kalimpong). 2000m. Fl. August.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From Kalimpong where the type material was collected.
NOTE. *H. kalimpongense* is related to *H. angustilabre* but differs in having a cordate, reticulate leaf and a single stem bract just above the leaf.

6. **H. lanceum** (Thunberg ex Sw.) Vuijk in Blumea 11(1): 228 (1961). Type: Java, Thunberg (holo. UPS-THUNB! Herb. no. 21289).
Ophrys lancea Thunberg ex Sw. in Kongl. Vetensk. Acad. Nya. Handl. 21: 223 (1800).
Satyrium lanceum (Thunberg ex Sw.) Persoon, Syn. Pl. 2: 507 (1807).
Aceras angustifolia Lindl. in Bot. Reg. 18: sub t.1525 (1832). Type: Nepal, Gossainthan, *Wallich's collectors* Wall. Cat. 7061 (holo. K-LINDL!, iso. K-W! L!).
A. longicruris C. Wright ex A. Gray in Mem. Am. Acad. Arts 6(1): 411 (1858). Type from Japan.
A. angustifolia var. *longicruris* (C. Wright ex A. Gray) Miquel in Ann. Mus. Bot. Lugduno-Batavi. 2: 207 (1866).
Platanthera angustifolia (Lindl.) Rchb. f., Otia Bot. Hamburg. 1: 39 (1878).
Herminium angustifolium (Lindl.) Bentham & Hook. f., Gen. Pl. 3: 622 (1880).
H. angustifolium var. *longicrure* (C. Wright ex A. Gray) Makino in Bot. Mag. (Tokyo) 10: 109 (1896).
H. altigenum Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 12: 334 (1922). Type: China (Xizang), Batang-Litang, *Limpricht* 2327 (holo. B†).
H. minutiflorum Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 19: 373 (1924). Type: China, Kwangtung, *C.O. Levine* 1479 (holo. B†).
H. stenostachyum T. Tang & F.T. Wang in Bull. Fan Mem. Inst. Biol. 7: 130 (1936). Type: China, Yunnan, *Henry* 13556 (holo. K!).
Monorchis angustifolia (Lindl.) Schwartz in Mitt. Thüring. Bot. Ges. 1: 95 (1941).

Herminium angustifolium var. *brevilabre* T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 61 (1951). Type: China, Yunnan, H.T. Tsai 61889 (holo. PE).
H. longicrure (C. Wright ex A. Gray) T. Tang & F.T. Wang, loc. cit (1951).
H. lanceum var. *longicrure* (C. Wright ex A. Gray) Hara in J. Jap. Bot. 44: 60 (1969).

Plant 20–60cm tall; *tubers* small, ovoid, 1.5–2 × 0.5–0.6cm. *Stem* erect, distantly 2- to 4-leaved, bracteate above leaves; basal sheaths overlapping, tubular, 2.5–7cm long, mouth wide; stem bracts leafy, linear-lanceolate, acuminate, 4–6 × 0.1–0.2cm. *Leaves* linear to linear-lanceolate, acuminate, sessile, sheathing at base, 6–20 × 0.4–1.7cm. *Inflorescence* slender, cylindric, densely many-flowered; rachis glabrous, 4–30cm long; floral bracts ovate-lanceolate to narrowly lanceolate, long-acuminate, 1-veined, 0.3–1.5 × 0.1–0.2cm. *Flowers* up to 1cm long, uniformly greenish-white; pedicel and ovary fusiform, 5–7mm long . *Dorsal sepal* concave, ovate, hooded, 1-veined, 2.5–3 × 0.8–1mm; *lateral sepals* oblique, ovate, obtuse, 1-veined, 2.5–3 × 0.8–1mm. *Petals* linear-lanceolate, subacute, hooded, 1-veined, 1.8–2 × 0.5–0.8mm. *Lip* 3-lobed from a narrow, semi-circular clawed base, 0.8–1 × 0.1cm; lateral lobes long linear-filiform, obtuse; mid-lobe oblong, obtuse. *Column* 0.8mm long. *Fruit* ovoid, sessile, erect, 5–7 × 2–2.5mm.

Bhutan: S – Chukka district (2km N of Takhti Chu); C – Thimphu (W side of Dochu La, Motithang to Phajoding, above Thimphu Hospital), Punakha (Tinlegang) and Bumthang (Lami Gompa) districts; **Darjeeling** (Batasi, Budhwari, Kurseong, Manibhanjan, Mungpu to Senchal, Phalut, Rambi, Ramman, Rimbik, Senchal); **Sikkim** (near Bitu, Dzongri, Mamring, N of Myang Chhu, Phalut, Singalila Range, Tendong, Yak La). On damp roadside bank, in wet broad-leaved forest, in open *Pinus wallichiana* forest, in marshy grassland and in *Picea* sp. forest; 1220–4000(–4570)m. Fl. July–October.

GENERAL DISTRIBUTION. India (Himalayas, Kashmir), Nepal, Myanmar, China, Thailand, SE Asia, Korea, Japan, the Philippines and south to Malaysia, Timor, Sulawesi and Java.
ETYMOLOGY. From the Latin *lanceus* (lance-shaped) in reference to the leaf shape.
NOTES. This is a widespread and highly variable species. Seidenfaden (1977a) found it difficult to justify a separation between var. *lanceum* and var. *longicrure*. Although the Chinese and Japanese specimens do have a more prominent and distinctive lip, the differences are are found to be inconsistent and we treat them as conspecific following recent Chinese authors (Wang, 1994).

H. alaschanicum Maximowicz has been treated as conspecific by some authors, however this species has a distinct spur and has now been transferred to *Peristylus* (Pearce *et al.*, 2001).

7. **H. mackinnonii** Duthie in J. Asiat. Soc. Bengal 71: 44 (1903). Type: India, W Himalaya, near Mussoorie, P.W. *Mackinnon* 25421 (holo. K!).

Plant sometimes epiphytic, 12–25cm tall; *tuber* narrowly cylindric, 1.2–2.5 × 0.9–1.4cm. *Stem* with leaves inserted near middle, ebracteate above leaves, 9–15.5cm; basal sheaths 2, overlapping, tubular, the upper 3.4–4.5cm long, the lower 0.5–2cm long. *Leaves* 2(–3), subopposite to distant, linear-lanceolate to oblong, acute to shortly acuminate, sessile, sheathing at base, 3- to 5-veined, 9–14 × 0.8–2cm; sheaths clasping. *Inflorescence* cylindric, subdensely many-flowered; rachis glabrous, narrowly winged, 5.5–12cm long; floral bracts broadly lanceolate, acuminate, 2–6 × 0.5–1.5mm. *Flowers* spreading, 3–5mm across; sepals green, petals white, lip white, with a pale green margin; pedicel and ovary ovate-oblong, glabrous, 3–5mm long. *Sepals* similar, ovate-oblong, acute, 1-veined, spreading, 2–4 × 1–2mm. *Petals* linear-lanceolate, acute, 1-veined, 2–4 × 0.5–0.8mm. *Lip* 3-lobed, clawed, deflexed from base, spurless, 1-veined; base thick, subquadrate, margins incurved, obscurely auriculate, 1–1.5 × 0.25–0.5mm; lateral lobes filiform, incurved, 1–2mm long; mid-lobe linear-lanceolate, obtuse, 1–1.3mm long. *Column* stout, 0.8mm tall; anther locules converging from base, 0.3mm long; pollinia obovate; caudicle very short; viscidium discoid; staminodes large; stigmas 2, transversely oblong, 0.5–0.8mm across. *Fruit* ovoid, sessile, 2.5–3.5 × 1.5–2cm.

Sikkim (unlocalised *Hooker* specimen). On *Quercus* and *Mahonia* sp.; on mossy rocks; 2130–2700m. Fl. August.

GENERAL DISTRIBUTION. NW India, Nepal and NE India.
ETYMOLOGY. Named after P.W. Mackinnon, a collector of plants and friend of John Duthie.
NOTE. This is closely related to *H. lanceum* but that species is generally a larger plant with a longer clawed base to the lip, and a cylindric ovary.

8. **H. macrophyllum** (D. Don) Dandy in J. Bot. 70: 328 (1932). Type: Nepal, *Wallich* s.n. (holo. BM!).
Neottia macrophylla D. Don, Prodr. Fl. Nepal: 27 (1825).
Spiranthes macrophylla (D. Don) Sprengel, Syst. Veg. ed.16, 3: 708 (1826).
Herminium congestum Lindl. in Bot. Reg. 18: sub t.1499 (1832). Type: Nepal, Gossainthan, *Wallich's collectors* Wall. Cat. 7068 (holo. K-LINDL!, iso. K-W! K! L!).

Plant 16–35cm tall; *tuber* ovoid-globose, pubescent, 0.8–2 × 0.5–1.4cm; *roots* filiform. *Stem* with leaves borne on lower third, ebracteate above; basal sheaths overlapping, tubular, obtuse, 3cm long, mouth wide. *Leaves* 2 or 3, close together, oblong, oblong-elliptic to oblanceolate, acute to subacute, sessile, sheathing, 7–12 × 0.4–2cm; sheath clasping. *Inflorescence* densely many-flowered; rachis glabrous, 3–9cm long; floral bracts small, ovate-lanceolate to triangular, acute, 0.5–1.2 × 0.2–0.3mm. *Flowers* pendent, 2–3.5mm across, uniformly green; pedicel and ovary ovoid, hooked at apex, 2.5–3.5mm long. *Dorsal sepal* broadly ovate, obtuse, 1-veined, 0.8–1.5 × 0.8–1mm; *lateral sepals* oblong, subacute, spreading, 1-veined, 1.5–2 × 0.5–1mm. *Petals* triangular-lanceolate, acute, oblique, 1-veined, 1–2 × 0.8–1.2mm. *Lip* obscurely 3-lobed, fleshy, ovate-lanceolate, obtuse, spurred, 1.8–2.2 × 0.8–1mm; lateral lobes narrow, rounded, margins crenulate; mid-lobe entire, surface weakly warty; disc 2-callose (at mouth of spur); *spur* minute, globose-saccate, 0.2–0.6mm long. *Column* 0.6–0.9mm tall; pollinia broadly ellipsoid; caudicles short; viscidium oblique, horn-like; staminodes oblong, tapering; stigmas 2. *Fruit* ovoid, shortly stalked, erect, 4–6 × 2–3mm.

Bhutan: C – Ha (Sela La), Thimphu (Chekha, above Pajoding Monastery, Tremo La) and Tongsa (Sephu Chu) districts; N – Upper Mo Chu (Gasa) and Upper Kulong Chu (Me La) districts; **Darjeeling** (Phalut, Ramman, Sandakphu, Singalila); **Sikkim** (Chiya Bhanjang, Lachen Valley, Lachung Valley, Meguthang, Rangpoo Chhu, Singalila Range, Tsomgo Chhu, Yumthang); **Chumbi** (Chubitang, Lingmathang). Growing with dwarf *Cotoneaster* sp. on ridge, in juniper scrub, on yak-grazed slopes and short grassland; 2870–4300m. Fl. June–August; Fr. August.

GENERAL DISTRIBUTION. Nepal, NE India and China (Xizang).
ETYMOLOGY. From the Greek *makros* (large) and *phyllon* (leaf).
NOTES. King & Pantling (1898) treated *Herminium unalaschkense* (Sprengel) Rchb. f. and *Habenaria schischmareffiana* Chamisso, from the Aleutian Islands within the synonymy of *H. macrophyllum*. These are now referred to *Piperia unalaschkensis* (Sprengel) Rydberg.

9. **H. monophyllum** (D. Don) P.F. Hunt & Summerhayes in Kew Bull. 20: 51 (1966). Type: Nepal. *Wallich* s.n. (holo. BM!).
Neottia monophylla D. Don, Prodr. Fl. Nepal: 27 (1825).
Spiranthes monophylla (D. Don) Sprengel, Syst. Veg. 3: 709 (1826).
Herminium gramineum Lindl. in Wall. Cat.: 7413 (1832), nom. nud.; Gen. Sp. Orchid. Pl.: 305 (1835). Type: Nepal, *Wallich's collectors* Wall. Cat. 7413 (holo. K-LINDL!, iso. K-W!).

Plant 4–12cm tall; *tuber* globose to globose-fusiform, 5–9 × 4–6mm. *Stem* erect, slender, ebracteate above leaf, 2.5–7cm tall; basal sheaths 1 or 2, overlapping, tubular, 0.9–2.2cm long, mouth wide. *Leaf* 1, linear-oblong to oblong, acute, sessile and sheathing at base, 3.5–5.5 × 0.2–0.6cm; sheath 0.8–1.8cm long. *Inflorescence* laxly to subdensely 8- to many-flowered; rachis glabrous, 2–6cm long; floral bracts lanceolate, acute to acuminate, margins minutely glandular, 3–8 × 1–1.5mm. *Flowers* 4–7mm across, uniformly yellowish-green; pedicel and ovary glabrous, 3.5–4.5mm long. *Dorsal sepal* oblong to oblong-ovate, obtuse, 1-veined, 2–2.5 × 1.2–1.5mm; *lateral sepals* ovate, obtuse, 1-veined, spreading, 2–3 ×

1–1.2mm. *Petals* suberect, linear-oblong, obtuse, weakly falcate, upper margin sub-crenulate, forming a hood with dorsal sepal, 2.5 × 0.8mm. *Lip* simple, ovate to ovate-lanceolate, acuminate, weakly saccate at base, concave, 2.5 × 1.5mm. *Column* 0.7–1mm tall.

Bhutan: N – Upper Mo Chu district (Gasa); **Sikkim** (Tsomgo Chho). On peat covered rocks by lake; 3660–4200m. Fl. June–August.

GENERAL DISTRIBUTION. NW India, Nepal and NE India.
ETYMOLOGY. From the Greek *monos* (one) and *phyllon* (leaf).

10. H. monorchis (L.) R. Br. in Ait. Hort. Kew ed.2(5): 191 (1813). Type: Herb. LINN. 1056.22 (lecto. LINN!), designated by Baumann *et al*. in Mitt. Bl. Arbeit. Heim. Orch. Baden-Württ. 21: 489 (1989).
Ophrys monorchis L., Sp. Pl.: 947 (1753).
Orchis monorchis (L.) Allioni, Fl. Pedem. 2: 148 (1785).
Arachnites monorchis (L.) Hoffmann, Deutschl. Fl. ed.2, 2: 179 (1804).
Satyrium monorchis (L.) Persoon, Syn. Pl. 2: 507 (1807).
Herminium alaschanicum var. *tanguticum* Maximowicz in Bull. Acad. Imp. Sci. Saint-Petersbourg sér.3, 31: 105 (1887). Type: China, Tangut (Gansu), *Przewalski* 1880 (holo. K!).
H. tanguticum (Maximowicz) Rolfe in J. Linn. Soc., Bot. 36: 51 (1903).

Plant 5–15cm tall; *tuber* ellipsoid to globose, 1 × 0.7cm. *Stem* erect, bracteate above leaves, 10–18cm tall; basal sheath 1, widely tubular, 1.5–1.8cm long; stem bract 1, linear-lanceolate, acuminate, 0.7–1.6 × 0.05–0.15cm. *Leaves* 2 or 3, closely spaced on lower half of stem, oblong-lanceolate, acute, 2.5–5.5 × 0.7–1.3cm. *Inflorescence* densely many-flowered; rachis glabrous, 2–3cm long; floral bracts lanceolate, 2–5mm long. *Flowers* fragrant (of musk), decurved, 4mm across, uniformly yellowish-green; pedicel and ovary glabrous, 3–5mm long. *Dorsal sepal* oblong, obtuse, 1–2.5 × 0.8–1mm; *lateral sepals* oblong-lanceolate, weakly falcate, subacute, 2–3 × 0.6–1mm. *Petals* obliquely oblong to oblong, apices fleshy, subacute, 1.5–4 × 0.5–1mm. *Lip* 3-lobed, 1.5–3mm long; base concave, shortly clawed; lateral lobes narrowly triangular, 0.5–1mm long; mid-lobe oblong, obtuse, 1–1.5mm long. *Column* 0.5–0.8mm tall. *Fruit* ovoid, sessile, erect, 6–8 × 2.5–3.5mm.

Sikkim (unlocalised *Hooker* specimen); **Chumbi** (E of Yatung). 3050m. Fl. August.

GENERAL DISTRIBUTION. Widespread through Europe to the Himalayas and China.
ETYMOLOGY. From the Greek *monos* (one) and *orchis* (tuber, testicle).

11. H. orbiculare Hook. f., Fl. Brit. India 6(1): 130 (1890); Icon. Pl. 22: t.2199b (1894). Type: China (Xizang), Chumbi Valley, Kungphu, *King's collector* 164 (holo. K!).

Plant 8–15cm tall; *tuber* globose, elongate, 8 × 8mm. *Stem* slender, bracteate above leaves, 7–14cm tall; basal sheaths 1 or 2, tubular, 0.8–1cm long; stem bracts many, linear, margins minutely glandular-pubescent, 4–6 × 0.8–1mm. *Leaves* 2, on lower third of stem (or sub-basal), subopposite to distant, oblanceolate to elliptic-oblong, subacute, shortly petiolate to sessile, sheathing at base, reticulately marked, 1.8–2.5 × 0.4–1.6cm; sheaths tubular, 0.6–1cm long. *Inflorescence* secund, densely many-flowered; rachis glabrous, 1.5–4cm long; floral bracts oblong-lanceolate, obtuse, margins minutely glandular-pubescent, 2.5–3 × 0.6–1mm. *Flowers* 2–3mm across, uniformly green; pedicel and ovary swollen, oblong, 2.5–3mm long. *Dorsal sepal* orbicular-oblong, obtuse, 1-veined, 0.6–0.8 × 0.4–0.5mm; *lateral sepals* narrowly orbicular-oblong, obtuse, 1-veined, 1–1.5 × 0.6–0.8mm. *Petals* broadly oblong, obtuse, 1-veined, 0.9–1 × 0.3–0.4mm. *Lip* simple, spurred, orbicular, fleshy, with a central pit at base, glandular and thickened at apex, 1.5–1.7 × 1.2–1.4mm; spur 0.5–0.7mm long. *Column* 0.3–0.4mm tall; anther locules divergent; pollinia clavate; caudicle attenuate; viscidium orbicular, translucent; rostellum minute; stigmas conjoined. **Fig. 43.**

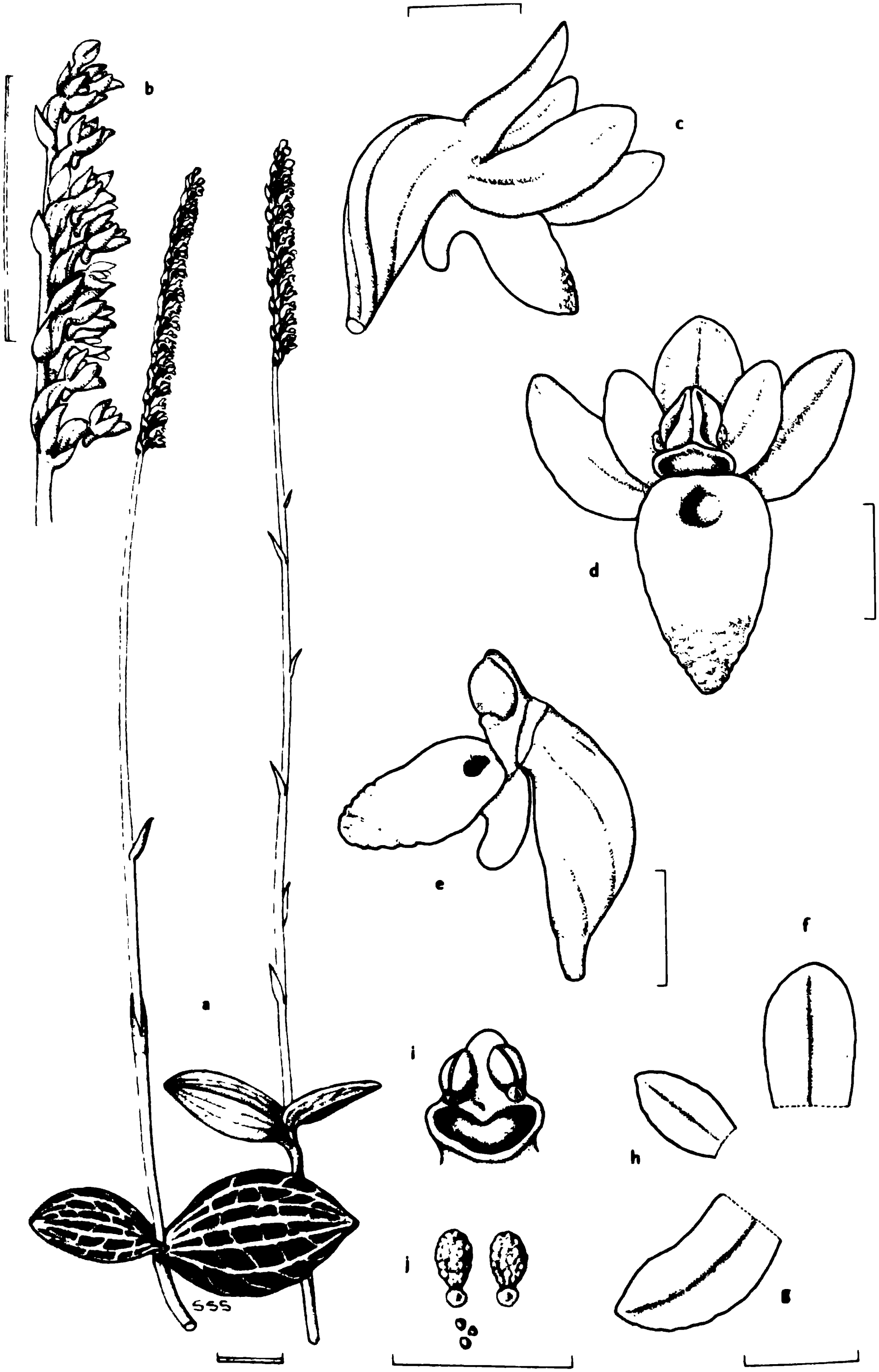


Fig. 43 **Herminium orbiculare**: a, habit (two views); b, inflorescence; c, flower (side view); d, flower (front view); e, lip, column and ovary; f, dorsal sepal; g, lateral sepal; h, petal; i, column; j, pollinaria with massulae. Drawn by Susanna Stuart-Smith from *Pantling* 348 (K).

Bhutan: C – Thimphu district (Barshong to Dotena); **Darjeeling** (Singalila); **Sikkim** (Powngong?, Singalila); **Chumbi** (Kungphu). On wet moss, on rocks by stream, in open *Juniperus*/*Abies* forest; 3050–3660m. Fl. July–September.

GENERAL DISTRIBUTION. NE India and China (Xizang).

ETYMOLOGY. From the Latin *orbicularis* (circular in outline) in reference to the lip shape.

12. **H. pygmaeum** Renz in Edinb. J. Bot. 58(1): 106; Fig. 4 (2001). Type: Bhutan, Thimphu district, below Darkey Pang Tso, *Nolthe* 105 (holo. E!).

Plant 2–5cm tall; *tuber* globose, pubescent, 3–4 × 2–3mm. *Stem* erect, slender, bracteate above leaves, 1.5–3.5cm long; basal sheath large for plant, apex ovate, subacute, 1–1.5cm long, mouth wide; stem bract lanceolate, acute, 2.5 × 0.5mm. *Leaves* 3, linear-oblong, subacute, emerging from within basal sheath, 1.5–3.5 × 0.05–0.15cm. *Inflorescence* secund, subdensely 3- to 5-flowered; rachis glabrous, 5–7mm long; floral bracts minute, lanceolate, acute, 0.5–1 × 0.5–0.6mm. *Flowers* 3mm long; sepals green, petals yellowish; pedicel and ovary swollen, narrowed towards apex, 3 × 1–1.3mm. *Dorsal sepal* ovate, subacute to obtuse, slightly warty on exterior surface, 3 × 2mm; *lateral sepals* lanceolate-ovate, subacute, 1-veined, 4 × 1.5mm. *Petals* trowel-shaped, constricted towards apex, apex fleshy, subacute, 1-veined, 3.5 × 1.5mm. *Lip* 3-lobed, base long and gradually widening, spurless, 4 × 1.5mm; lateral lobes triangular, obtuse; mid-lobe narrowly triangular, acute, 1mm long. *Column* 0.5mm tall.

Bhutan: C – Thimphu district (below Darkey Pang Tso). On very wet cliff ledge, with *Juncus trichophyllus* and *Parnassia* sp.; 3960m. Fl. August.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. From the Latin *pygmaeus* (dwarf) in reference to the size of the plant.

13. **H. quinquelobum** King & Pantling in J. Asiat. Soc. Bengal 65(2): 130 (1896). Type: India, Sikkim, Tendong, *Pantling* 339 (holo. CAL, iso. K!).

Plant 21cm tall; *tuber* cylindric-fusiform, 2 × 0.4cm. *Stem* slender, bracetate above leaves, 9.5cm long; basal sheaths 2, overlapping, 1.6–3cm long, mouth wide; stem bract 1, leaf-like, linear-lanceolate, acuminate, 3.5 × 0.2cm. *Leaves* 2, basal, arising from within basal sheaths, linear-oblong, subacute, 14–16 × 0.9–1.3cm. *Inflorescence* subdensely many-flowered; rachis glabrous, narrowly winged, 12cm long; floral bracts lanceolate, acuminate, becoming smaller up rachis, 4–9 × 0.8–1.5mm. *Flowers* 3–4mm across, uniformly green; pedicel and ovary 2.5–3mm long. *Dorsal sepal* oblong to oblong-elliptic, obtuse, erect, 1-veined, 2 × 0.6mm; *lateral sepals* oblong to oblong-elliptic, obtuse, 1-veined, spreading, 1.8 × 0.8mm. *Petals* linear, acuminate, spreading, 1-veined, 1.8 × 0.2mm. *Lip* 5-lobed, spurless, 2 × 0.6mm (across lateral lobes); basal auricles triangular, small; lateral lobes triangular, elongate; mid-lobe narrowly triangular, acuminate. *Column* broad, 0.5mm long; anther locules parallel, 0.3mm long; pollinia broadly ovoid; caudicle short; viscidium discoid; staminodes oblong; stigmas 2, transversely oblong.

Sikkim (Tendong). 2330m. Fl. August.

GENERAL DISTRIBUTION. Nepal, NE India and China.

ETYMOLOGY. From the Latin *quinque-* (five) and *lobus* (lobed) in reference to the lip.

NOTES. *H. quinquelobum* is closely related to both *H. jaffreyanum* and to *H. mackinnonii*. The relationship with *H. mackinnonii* is so close that it might represent a semi-peloric form of that species in which the lateral lobes of the lip have been lost.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

H. longilobatum Hegde & A.N. Rao in Himalayan Pl. J. 1(2): 47 (1982). Type: India, Arunachal Pradesh, W Kameng, Towang, *Hegde* 320 (holo. Orchid Herbarium Tipi, iso. CAL, Orchid Herbarium Tipi).

NOTE. Reported from Towang in the W Kameng district of Arunachal Pradesh.

43. **Neottianthe** Schltr.

Plants terrestrial, slender; *tubers* 2, cylindric or ellipsoid. *Stem* with several basal, bladeless sheaths. *Leaves* 2, basal, unspotted. *Inflorescence* terminal, racemose, few- to many-flowered (rarely 1-flowered), often secund; floral bracts leaf-like. *Flowers* resupinate; ovary subsessile, cylindric to fusiform, twisted, glabrous. *Sepals* and *petals* similar, connivent to form a hood. Lip 3-lobed, spurred, usually papillose above; *spur* decurved, conical. *Column* suberect; rostellum 3-lobed; pollinia 2; caudicles very short; viscidia placed close together and parallel above the stigma, bursicles absent.

The genus *Neottianthe* was established in 1919 by R. Schlechter in *Feddes Repertorium Specierum Novarum Regni Vegetabilis*. The genus comprises about 11 species distributed in NE Europe, temperate Asia from the Baltic states to China, Japan and the Himalayas.

Xi, Lang & Hu (1988) reviewed the taxonomic significance of pollen morphology in *Neottianthe*.

TYPE. *Neottianthe cucullata* (L.) Schltr.; basionym: *Orchis cucullata* L.
ETYMOLOGY. From *Neottia* (a genus of orchids) and the Greek *anthos* (flower) a reference to the superficial resemblance of the flowers to those of *Neottia*.

Key to species

1. Leaves 2 or 3, inserted along stem .... **2. N. secundiflora**
+ Leaves 1 or 2, basal, opposite to subopposite 2

2. Stem bracteate above leaves .... **1a. N. cucullata** var. **cucullata**
+ Stem ebreactate above leaves .... **1b. N. cucullata** var. **calcicola**

1. N. cucullata (L.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 16: 292 (1919). Type: Russia, based on Gmelin, Fl. Sibir. 1: 16, no.14, t.3, f.2 (1747)!
Orchis cucullata L., Sp. Pl.: 939 (1753).
Gymnadenia cucullata (L.) L.C. Richard in Mém. Mus. Hist. Nat. 4: 57 (1818).
Habenaria cucullata (L.) Höfft, Cat. Pl. Kourst.: 56 (1826).
Himantoglossum cucullatum (L.) Rchb., Fl. Germ. Excurs.: 920 (1830).
Gymnadenia pseudodiphylax Kränzlin in Engler, Bot. Jahrb. Syst. 36(Beibl. 82): 25 (1905). Type: China, Shandong, *Scallan* 6916 (holo. B†).
G. scabrilinguis Kränzlin, op. cit. 26 (1905). Types: China, *Giraldi* 6882 & 6923 (syn. B†).
G. monophylla Ames & Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 43 (1919). Type: China, Szechuan (Sichuan), *Wilson* 4722 (holo. AMES!).
Neottianthe pseudodiphylax (Kränzlin) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 16: 291 (1919).
N. monophylla (Ames & Schltr.) Schltr., op. cit. 292 (1919).
N. pseudodiphylax var. *monophylla* (Ames & Schltr.) Soó in Ann. Hist.-Nat. Mus. Natl. Hung. 26: 354 (1929).

1a. var. cucullata

Plant erect, 15–24cm tall; *tubers* ovoid, 1–1.8 × 0.7–1.8cm. Stem slender, bracteate at intervals above leaves, glabrous; basal sheaths lanceolate, acuminate, weakly keeled, 0.8–1.4 × 0.1–0.15cm. *Leaves* 1 or

2, basal, lanceolate-ovate, acute, surface with reticulate markings, 1.5–6.5 × 0.5–2.5cm; petiole channelled, extending into sheathing base, 0.4–1cm long. *Inflorescence* subdensely 8- to 18-flowered; rachis glabrous, 3.8–6.2cm long; floral bracts lanceolate, acuminate, 5–6 × 1–1.5mm. *Flowers* 3–5mm across, uniformly dull purple to pink-violet; pedicel and ovary spirally twisted, glabrous, 3–4mm long. *Dorsal sepal* lanceolate, acute, 1-veined, 3.5–4 × 1.5–1.8mm; *lateral sepals* lanceolate to wedge-shaped, weakly falcate, acute to acuminate, 1-veined, 3.5–4.4 × 1–1.5mm. *Petals* filiform, forming a hood with the dorsal sepal, 1-veined, 3.6–3.8 × 0.1–0.5mm. *Lip* 3-lobed, spurred, surface densely glandular-pubescent, 4.6–5mm long; base widely clawed, densely glandular-pubescent at opening to spur, 1–2mm long; lateral lobes linear-oblong, obtuse, 1.2–3mm long; mid-lobe oblong 2.2–4mm long; *spur* curved, porrect, base broad, tip globose, 3.5–4mm long. *Column* 1–1.3mm long; pollinaria 1.2–1.3mm long. **Fig. 44.**

Bhutan: C – Thimphu district (above Thimphu hospital). In partial shade in *Pinus wallichiana* scrub, on dry hill, in moist *Pinus*/*Abies* forest on limestone slopes, riverside with *Populus ciliata* and dense mixed forest; 2700–2900m. Fl. August.

GENERAL DISTRIBUTION. E Europe, Poland, Russia, China, Nepal, N India, and Japan.
ETYMOLOGY. From the Latin *cucullatus* (hood-like) in reference to the form of the sepals and petals.
NOTE. This is the first record of this variety from Bhutan.

1b. var. **calcicola** (W.W. Smith) Soó in Ann. Hist.-Nat. Mus. Natl. Hung. 26: 353 (1929). Types: China, Yunnan, Lichiang Range, *Forrest* 6536 (syn. E!, isosyn. AMES! K!); Yunnan, Tali Valley, *Forrest* 7375 (syn. E!).
Gymnadenia calcicola W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 8(38): 188 (1914).
Neottianthe calcicola (W.W. Smith) Schltr. in Acta Horti Gothob. 1: 136 (1924).

Plant 8–17cm tall; *tubers* globose, 1–1.4 × 0.8–1.3cm. *Stem* erect to slightly curved, ebracteate above leaves, 3.5–6.5cm tall; basal sheath membranous, tubular, 1–1.4cm tall. *Leaves* 2 (upper sometimes reduced and bract-like), inserted towards base of stem, linear-lanceolate to oblanceolate, subacute to acute, sessile and sheathing at base, 4–7 × 0.5–1cm; sheath 0.7–1.5cm long. *Inflorescence* secund to subsecund, subdensely 6- to 12-flowered; rachis glabrous, 2.5–7cm long; floral bracts ovate-lanceolate, oblanceolate to linear, acuminate, 1-veined, 0.6–1.1 × 0.15–0.2cm. *Flowers* fragrant, 1–1.6cm long, uniformly pink; pedicel and ovary swollen, weakly curved, 6–8mm long. *Sepals* similar, lanceolate, oblique, subacute, 3-veined, 0.7–1 × 0.3–0.4cm. *Petals* linear, obtuse, 1-veined, 0.7–1 × 0.1–0.15cm. *Lip* 3-lobed, spurred, surface papillose, 8.5–9mm long; lateral lobes linear, 4–5mm long; mid-lobe linear to oblong, 5–6.5mm long; *spur* incurved, obtuse, thickened, 4–5mm long. *Column* 1.5–2mm tall; anther locules parallel, c.1.2mm long.

Bhutan: C – Thimphu district (above Pajoding Monastery, Paro); **N** – Upper Kulong Chu district (Me La Chu); **Sikkim** (Chemathang, Lachung); **Chumbi** (Chomo Lhari, between Trakarpo and Yatung). On rough heathy grassland, open hillsides among *Juniperus* sp., on sandy peaty soils, subalpine *Betula utilis* and *Rhododendron* forest; 2740–4720m. Fl. August–September.

GENERAL DISTRIBUTION. Nepal and China.
ETYMOLOGY. From the Latin *calcicolus* (growing on lime rich soils).
NOTES. When describing *Gymnadenia calcicola*, W.W. Smith noted its similarity to *G. pseudodiphylax* (now treated in the synonymy of *N. cucullata*) and suggested that it might be a variety of that species. Soó treated it as a variety of *N. cucullata* and Wang (1994) reduced it to synonymy within *N. cucullata*. Although these two plants are very similar, var. *calcicola* is ebraceate above the leaves while var. *cucullata* is bracteate. The other differences do not, in our view, justify its retention at species level, so we follow Soó's treatment here.

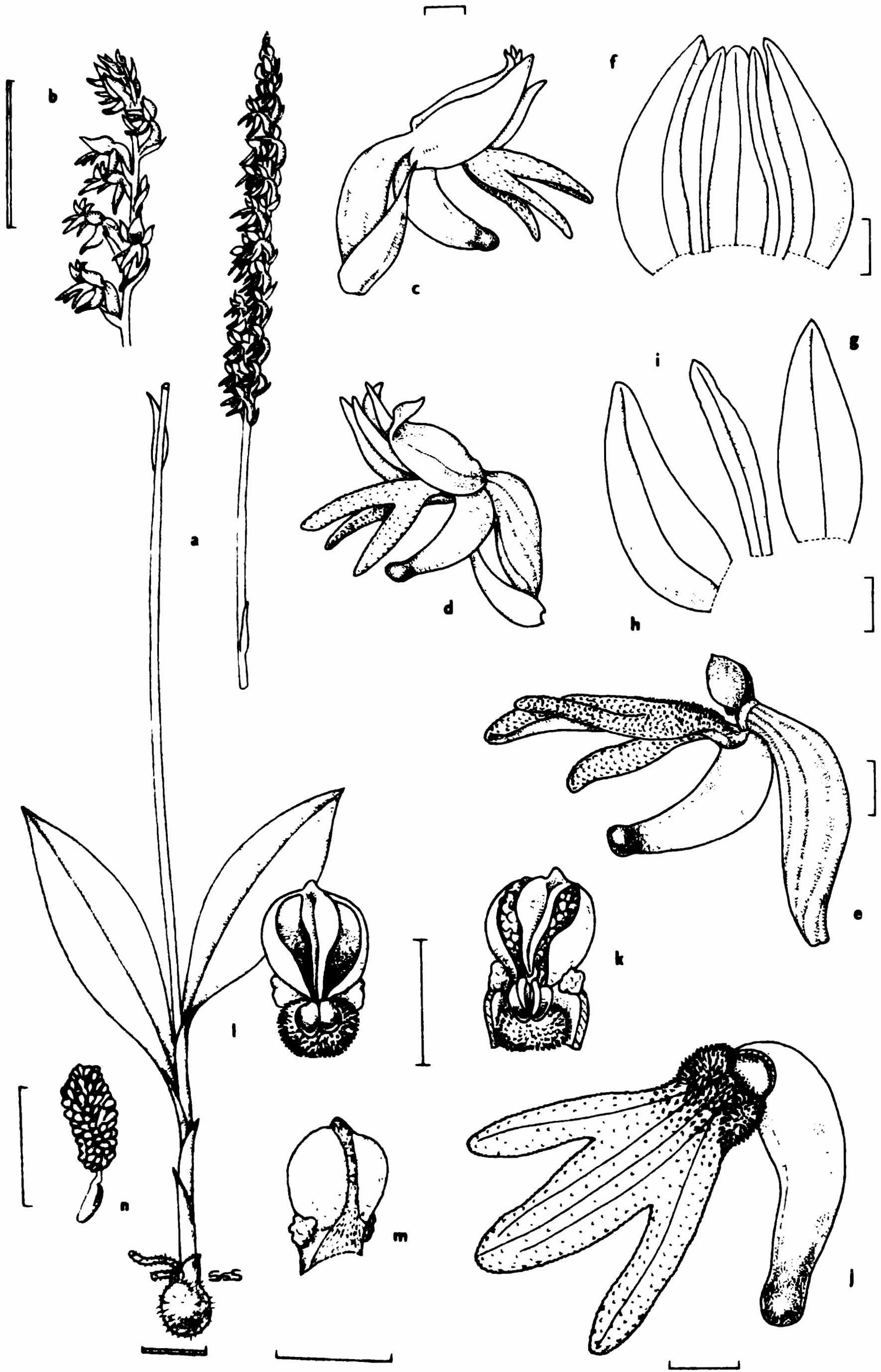


Fig. 44. **Neottianthe cucullata** var. **cucullata**: a, habit; b, rachis (enlarged); c–d, flower; e, lip, spur and ovary; f, sepals and petals (in natural state); g, dorsal sepal; h, lateral sepal; i, petal; j, lip and spur; k, column (front view); l, column (front view, pollinia removed); m, column (back view); n, pollinarium. Drawn by Susanna Stuart-Smith from Wood 5685 (E).

2. **N. secundiflora** (Hook. f.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 16: 291 (1919). Types: India, Kumaon, *Duthie* 3421 (syn. K!); India, Sikkim, *Hooker* 278 (syn. K-LINDL!); China (Xizang), Chumbi, *Dungboo* s.n. (syn. K!).
Habenaria secundiflora Hook. f., Fl. Brit. India 6(1): 165 (1890).
Peristylus secundiflorus (Hook. f.) Kränzlin, Orchid. Gen. Sp. 1: 518 (1898).
Gymnadenia secundiflora (Hook. f.) Kränzlin, op. cit. 936 (1901).
Neottianthe mairei Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 17: 24 (1921). Type: China, Yunnan, *E. Maire* s.n. (holo. B, iso. P).
Orchis secundiflorus (Hook. f.) Pradhan, Indian Orch.: Guide Identif. Cult. 1: 47 (1976).

Plant 9–31cm tall; *tubers* globose to ellipsoid, 8 × 7mm. *Stem* erect to recurved, bracteate above the leaves; basal sheath tubular, clasping, 1.5cm long; stem bracts linear, acuminate, 1-veined, 1–2 × 0.2–0.25cm. *Leaves* 2 or 3, distant, linear to linear-oblong, acute to acuminate, sessile and sheathing at base, 2–12.5 × 0.3–1cm; sheath 6–7mm long. *Inflorescence* erect, secund, subdensely 7- to many-flowered; rachis glabrous, 3–11cm long; floral bracts linear-lanceolate, acuminate, margins minutely glandular-ciliate, 0.5–1 × 0.1–0.18cm. *Flowers* 5–8mm long; uniformly pink; ovary swollen, curved, 5–7mm long. *Dorsal sepal* lanceolate to ovate-lanceolate, acute, 1–3-veined, 4–5 × 1.8–3mm; *lateral sepals* similar, weakly falcate. *Petals* linear, acuminate, weakly falcate, 1-veined, minutely papillose, forming a hood with the dorsal sepal, 5.5 × 1mm. *Lip* 3-lobed, spurred, sessile, linear-oblong to triangular-oblong, puberulous, strongly veined, 5–6 × 1.5–2mm (when spread); lateral lobes parallel to mid-lobe, triangular-lanceolate, acuminate, 1–2.5mm long; mid-lobe oblong-lanceolate, acuminate, 1.5–3.6mm long; *spur* funnel shaped, contracted at base, inflated, apex subacute, 3.5–4 × 1–1.5mm (at base). *Column* long, 1–1.5 × 0.8–1mm; anther locules parallel; pollinia clavate; caudicle short; viscidia large, cordate, membranous; staminodes oblong, rugulose; rostellum large, 2-lobed, flap-like; stigmas conjoined, transversely oblong.

Bhutan: N – Upper Mo Chu district (Rodochu); **Sikkim** (Lachen, Lachung); **Chumbi** (Chubitang, between Lingmatang and Trakarpo, Yatung). On banks and clearings in *Abies* forest; 2440–4200m. Fl. August–September.

GENERAL DISTRIBUTION. NW India, Nepal, NE India and China.
ETYMOLOGY. From the Latin *secundus* (turned to one side) and *-florus* (flowered) in reference to the inflorescence.

44. **Pecteilis** Rafinesque

Plants terrestrial, medium to large; *tuber* large. *Stem* erect, stout, leafy. *Leaves* several, inserted along stem, or in a basal rosette, ovate-elliptic to ovate, fleshy. *Inflorescence* terminal, laxly to densely few- to several-flowered. *Flowers* medium to large, showy; pedicel and ovary short. *Sepals* entire, elliptic, connivent to form a hood over the column. *Petals* linear, smaller than the sepals. *Lip* decurved, 3-lobed, spurred, ecallose; lateral lobes spreading, fringed to lacerate (rarely entire); mid-lobe smaller, entire; *spur* pendent, sigmoid, cylindric, elongate. *Column* erect; anther locules widely spaced; pollinia 2, clavate, sectile; viscidia 2, ovate to oblong; staminodes sessile; rostellum 3-lobed, lateral lobes tapering, mid-lobe erect, obtuse; stigmas sessile, adherent to base of lip.

The genus *Pecteilis* was established in 1836 by Rafinesque in his *Flora Telluriana*. It is related to *Habenaria* and *Gymnadenia* but has a different column structure. The genus comprises about eight species distributed in S and E Asia and the Malay archipelago.

TYPE. *Pecteilis susannae* (L.) Rafinesque; basionym: *Orchis susannae* L.
ETYMOLOGY. From the Greek *pecteilon* (to comb) in reference to the lateral lobes of the lip.

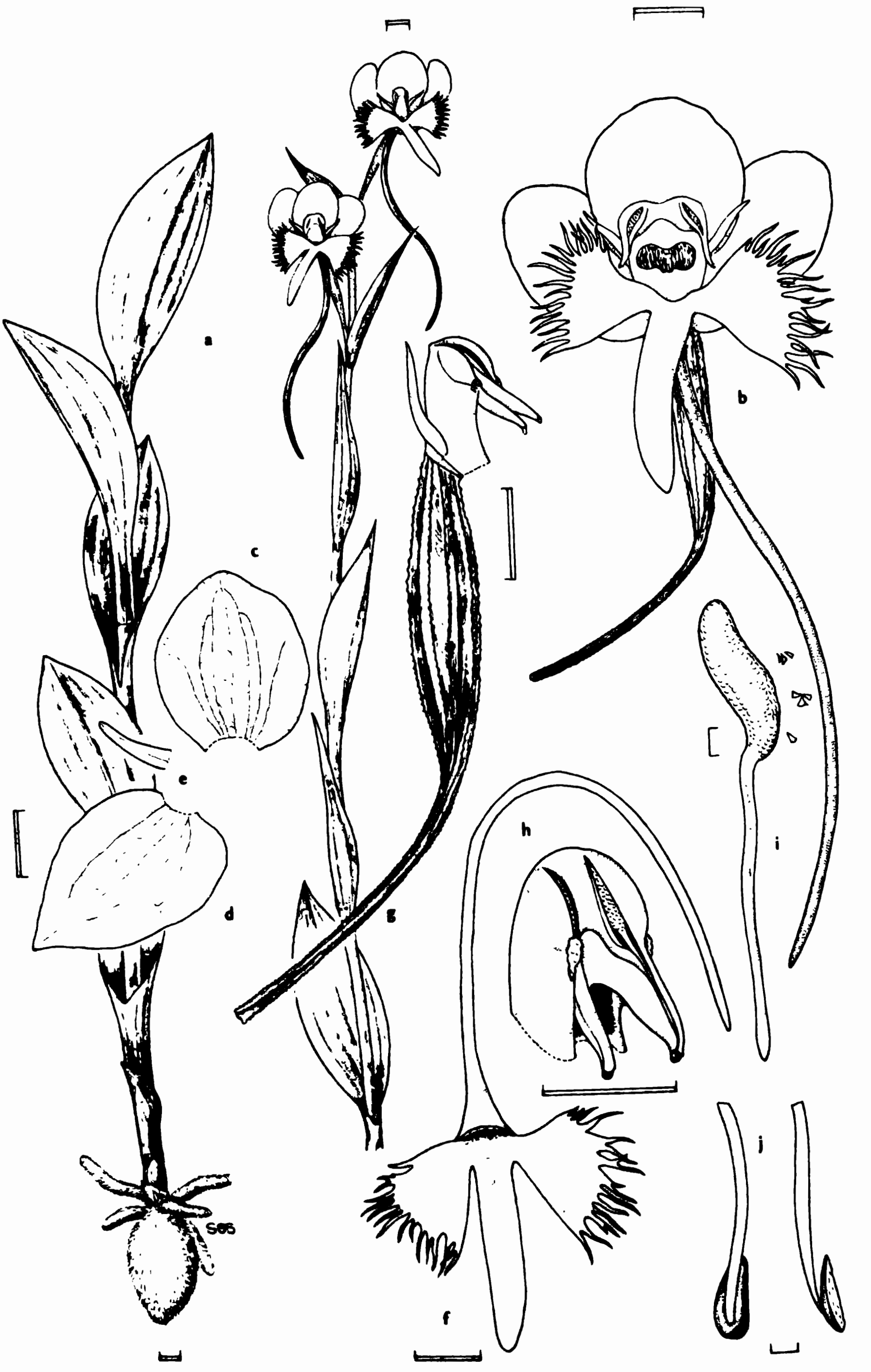


Fig. 45. **Pecteilis susannae**: a, habit (in two sections); b, flower; c, dorsal sepal; d, lateral sepal; e, petal; f, lip; g, ovary and column; h, column; i, pollinarium with massulae; j, stipe and viscidium (two views). Drawn by Susanna Stuart-Smith, a from *Hooker* s.n. (K); b–i from *Venning* 30 (K); j from *Koelz* 18995 (K).

1. **P. susannae** (L.) Rafinesque, Fl. Tellur. 2: 38, no.125 (1836). Type: [icon.] '*Orchis Amboinensis floribus albis fimbriatis*' in Hermann, Parad. Bat.: t.209 (1698)! designated by Cribb in Cafferty & Jarvis in Taxon 48(1): 49 (1999).

Orchis susannae L., Sp. Pl.: 939 (1753).

Habenaria susannae (L.) R. Br., Prodr.: 312 (1810).

Platanthera robusta Lindl. in Wall. Cat.: 7036 (1828), *nom. nud.*; Gen. Sp. Orchid. Pl.: 295 (1835). Type: Myanmar, Mt. Prome, coll. *Wallich* Wall. Cat. 7036 (holo. K-LINDL!, iso. K-W!).

P. susannae (L.) Lindl., Gen. Sp. Orchid. Pl.: 295 (1835).

Hemihabenaria susannae (L.) Finet in Rev. Gen. Bot. 13: 532 (1901).

Plant robust, erect, 60–100cm tall; *tuber* ovoid-cylindric, 5–6.5 × 2–2.5cm. *Stem* leafy, thick, bearing bladeless sheaths at base, 0.5–1.2cm wide; basal sheaths tubular, 3.5–5cm long. *Leaves* many, distant, ovate-oblong, acute, sessile and sheathing at base, 6–15 × 2.8–7cm; sheaths tubular, clasping, 2–7cm long. *Inflorescence* subumbellate, laxly 3- to 5-flowered; floral bracts lanceolate, acute to acuminate, margins minutely glandular-pubescent, 5–6 × 1–1.1cm. *Flowers* fragrant, 4–10cm wide, uniformly white; pedicel and ovary narrowly fusiform, winged, margins of wings minutely dentate, 4–7cm long. *Dorsal sepal* broadly ovate to rhombic, obtuse, 7-veined, 2.5–3.6 × 2.5–3.8cm; *lateral sepals* broadly ovate, oblique, subacute, spreading, 5-veined, 2–4.5 × 1.5–2.5cm. *Petals* short, linear to oblong, acute, 0.7–1.3 × 0.2cm. *Lip* distinctly 3-lobed, spurred; lateral lobes broadly triangular, truncate, lacinate-pectinate, 2–3.5 × 2–3cm; mid-lobe linear to oblong or linear-spathulate, obtuse, 3–4.5 × 0.5–0.9cm; *spur* long-cylindric, 7–14cm long. *Column* erect, 0.9–1.3cm tall; anther locules widely spaced, 8–9mm long; pollinia clavate; caudicle long; viscidia ovate; staminode prominent; stigmas large. **Fig. 45.**

Darjeeling (Chota Rangit River (Ghose, 1964)).

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand, Cambodia, Vietnam, Malaysia and Indonesia.

ETYMOLOGY. Named after Susanna, wife of G. Rumphius, the 17th century author of *Herbarium Amboinense*.

NOTES. Reported by Ghose (1964) from Darjeeling but we have seen no material from the area ourselves. The relationship between *P. susannae* and *P. gigantea* Rafinesque was reviewed at length by Vuijk (1964, 1965). They are closely related, but *P. susannae* has much shorter petals and the lip has shorter pectinate lateral lobes. Although Ghose identified *P. susannae* it is possible that his plant might have been a misidentification for *P. gigantea*. Chowdhery (1998) reported *P. susannae* from the Kameng district of Arunachal Pradesh but his illustration is of *P. gigantea*. Further field work on these two species is required before this problem can be resolved.

45. Peristylus Bl.

Plants terrestrial or sometimes epiphytic, small to medium; *tubers* small, cylindric to ellipsoid. *Stem* erect, bearing bladeless sheaths at base, few- to several-leaved, leaves basal, distant or inserted at middle of stem. *Leaves* thin, linear to broadly elliptic, not jointed, uppermost bract-like. *Inflorescence* terminal, racemose, laxly to densely few-to many-flowered. *Flowers* small, resupinate; pedicel and ovary porrect, close to rachis. *Dorsal sepal* and *petals* forming a hood over column. *Petals* broad. *Lip* simple to 3-lobed, connate at base with the margins of the column, ecallose or callose; *spur* short, pouch-shaped to cylindric. *Column* short; stigmas 2, sessile, convex, cushion-like to flat and clavate; stigma arms 2, remote, adnate to base of lip and staminodia; pollinia 2, shortly clavate, sectile; caudicles very short, attached to short rostellar lateral lobules; viscidia 2, ovate to oblong; staminodia sesile; rostellum small, 3-lobed (lateral lobes short).

The genus *Peristylus* was established in 1825 by Blume in his *Bijdragen tot der Flora van Nederlandsch Indië* and comprises over 100 species widely distributed in SE Asia. Seidenfaden (1977a) revised the Thai species and a fuller synonymy of the widespread species can be found there.

LECTOTYPE. *Peristylus grandis* Bl., typ. cons.
ETYMOLOGY. From the Greek *peri-* (around) and *stylos* (column) in reference to the prominent glands on each side of the gynostemium.

Key to species

1. Lip simple; oblong (sometimes narrowly) 2
+ Lip 3-lobed 3

2. Lip resupinate .... **8. P. nematocaulon**
+ Lip non-resupinate .... **12. P. superanthus**

3. Lateral lobes of the lip exceeding the mid-lobe .... **13. P. tipuliferus**
+ Lateral lobes of the lip equal to, or shorter than, the mid-lobe 4

4. Lip with a basal callus .... **7. P. lacertiferus**
+ Lip ecallose 5

5. Leaf 1 .... **4. P. fallax**
+ Leaves 2 or more 6

6. Leaves sub-basal .... **3. P. elizabethae**
+ Leaves distributed along, or clustered about the middle of, stem 7

7. Leaves linear-lanceolate; floral bracts long-acuminate or bristle-like .... **6. P. hamiltonianus**
+ Leaves broadly lanceolate to ovate; floral bracts not long-acuminate nor bristle-like 8

8. Sepals pale brown, petals and lip pure white .... **2. P. constrictus**
+ Sepals olive to brownish-green, lip creamy white 9

9. Lateral sepals not obliquely spreading, edges not strongly inrolled 10
+ Lateral sepals obliquely spreading, edges strongly inrolled 11

10. Anther not covered by side-wings of the column; pollinia not in a pouch .... **10. P. prainii**
+ Anther covered by side-wings of the column; pollinia in a pouch .... **11. P. pseudophrys**

11. Basal half of lip with a wide opening to spur .... **1. P. affinis**
+ Basal half of lip with a minute opening to spur 12

12. Spur globose .... **5. P. goodyeroides**
+ Spur broadly fusiform .... **9. P. parishii**

1. P. affinis (D. Don) Seidenfaden in Dansk Bot. Arkiv. 31(3): 48, t.23 (1977). Type: Nepal, Toka, coll. Wallich Wall. Cat. 7066A p.p. (lecto. CAL, isolecto. K-LINDL! K-W!), designated by Prain in King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 327 (1898).
Habenaria affinis D. Don, Prodr. Fl. Nepal: 25 (1825).
H. sacculata Wall. mss. nom. nud.
Peristylus sampsoni Hance in J. Bot. 6: 37 (1868). Type: China, Canton, *Sampson* 14493 (holo. K!).
Habenaria sampsoni (Hance) Hance, op. cit. 7: 163 (1869).
H. goodyeroides sensu Hook. f., Fl. Brit. India 6(1): 161 (1890), non D. Don.
H. goodyeroides var. *affinis* King & Pantling in Ann. Roy. Bot. Gard. (Calcutt) 8: 327, t.430 (1898).
Type: India, Sikkim, *Pantling* 453 (holo. CAL, iso. BM! K!).
Peristylus goodyeroides var. *affinis* (King & Pantling) Cooke, Fl. Bombay 2: 712 (1908).

Plant 15–21cm tall; *tubers* ellipsoid to cylindric, pubescent, 1.5–2 × 0.3–0.8cm. *Stem* erect, sheathed at base, leaves central, bracteate above, 10–27cm tall; basal sheaths 3, tubular, 2.2–5.5cm long, mouth wide; stem bracts lanceolate, 1.8–2.2 × 0.3–0.4cm. *Leaves* 3 or 4, clustered, ovate to ovate-elliptic, acute, narrowed and shortly sheathing at base, 3.5–5 × 1.5–3cm; sheaths 1.5–2cm long. *Inflorescence* densely to subdensely many-flowered; rachis glabrous, 3.8–12cm long; floral bracts lanceolate, acuminate, 1-veined, 5–9 × 1.8–2mm. *Flowers* 4–5mm across, uniformly white, cream or greenish, sepals tinged brown; pedicel and ovary twisted, 4–6mm long. *Dorsal sepal* broadly ovate-lanceolate, apiculate, concave, forming hood with petals, 3–3.5 × 1.5–1.8mm; *lateral sepals* oblong, apiculate, 3–3.5 × 1–1.4mm. *Petals* oblique, rhombic, 2.5–3 × 1.5–1.8mm. *Lip* 3-lobed, spurred, subquadrate, base shortly clawed, 1.5–2.5 × 2–2.2mm; base (hypochile) saccate with a papillose ridge on either side of the spur orifice, lateral lobes oblong to triangular, obtuse, 1–1.4mm long; mid-lobe oblong, obtuse, 0.8–1mm long; spur saccate, 1–1.5mm long. *Column* 0.8–1mm tall; stigmas lateral; pollinia pyriform; caudicle short; viscidium obovoid; rostellum falcately 2-lobed.

Sikkim (unlocalised *Pantling* specimen). 610m. Fl. June.

GENERAL DISTRIBUTION. NW India, Nepal, NE India, Myanmar, China, Thailand and ?Laos (Seidenfaden, 1992).

ETYMOLOGY. From the Latin *affinis* (related to) in reference to the close relationship to *P. goodyeroides*.

NOTE. Seidenfaden (1977a) reviewed the history of this species and considered that the large saccate lip base and the lateral stigmas justified its specific distinctness from *P. goodyeroides*.

2. **P. constrictus** (Lindl.) Lindl., Gen. Sp. Orchid. Pl.: 300 (1835). Type: India, Assam, Gualpara, coll. *Buchanan-Hamilton* Wall. Cat. 7043B (syn. K-LINDL!, isosyn. K-W!); icon. Wallich 707 (syn. K!).

Orchis leucantha Buchanan-Hamilton, mss. *nom. nud.*

Herminium constrictum Lindl. in Bot. Reg. 18: sub t.1499 (1832).

Habenaria constricta (Lindl.) Hook. f., Fl. Brit. India 6(1): 161 (1890).

H. cylindrocalyx Gagnepain in Bull. Soc. Bot. France 78: 68 (1931). Type from Vietnam?

Plant 40–110cm tall; *tuber* cylindric, pubescent, c.6 × 3cm. *Stem* erect, bearing leaves in lower half, bracteate above, 26–70cm long; basal sheaths tubular, expanded above, 5.5–6cm long, mouth wide; stem bracts in subopposite pairs or distant, linear-lanceolate, acuminate, 1.6–2.5 × 0.2–0.3cm. *Leaves* 4–6, ovate-elliptic to ovate-lanceolate, acute, shortly petiolate and sheathing at base, reticulately marked, 9–19.5 × 1.9–8cm; petiole channelled, 0.8–1.5cm; sheaths tubular, 1.5–4cm long. *Inflorescence* cylindric, subdensely many-flowered; rachis glabrous, 9–35cm long; floral bracts erect, lanceolate, acuminate, 0.9–1.8 × 0.15–0.25cm. *Flowers* horizontal, 0.8–1.4cm long; sepals pale brown, petals and lip pure white or with brown blotches; pedicel and ovary erect, glabrous, twisted, 7–9mm. *Dorsal sepal* oblong-lanceolate, obtuse, 0.7–1 × 0.2–0.3cm; *lateral sepals* oblong-lanceolate to linear-lanceolate, subacute, spreading, 1-veined, 7–9 × 1.5–2mm. *Petals* obliquely ovate to lanceolate, subacute, 3-veined, 0.8–1 × 0.25–0.3cm. *Lip* deeply 3-lobed, spurred, 1.1–1.2cm long; base clawed, narrow to broad, 3–4mm long; lateral lobes linear, weakly falcate, diverging, 3–6mm long; mid-lobe oblong, tapering, obtuse, 5mm long; spur globose, compressed, 1.8–2 × 1.3–1.8mm. *Column* broad, c.1mm tall; anther locules close, lacking tubes; pollinia oblong-ovoid; caudicles short; viscidium oblong-elliptic; stigmas 2, obovate-oblong; staminodes oblong.

Darjeeling (Kalimpong, Senchal, Sivok). 300–2330m. Fl. June–August.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China (Yunnan), Thailand, Cambodia and Vietnam.

ETYMOLOGY. From the Latin *constrictus* (contracted) probably a reference to the dense inflorescence.

3. P. elizabethae (Duthie) R.K. Gupta, Fl. Nainital.: 351 (1968). Types: India, W Himalaya, Song, *Brandis* s.n. (syn. CAL); Simla, *Edgworth* s.n. (syn. CAL); E. *Babington-Smith* s.n. (syn. CAL); Naini Tal, *Davidson* s.n. (syn. CAL); Tehri-Garhwál, *Duthie* 524, (syn. CAL); NW India, Tehri-Garhwal, Nag Tiba, *Mackinnon* 22990A (syn. K!); NW India, near Mussoorie, *Mackinnon* 22990 (syn. K!).
Habenaria elizabethae Duthie in J. Asiat. Soc. Bengal 71: 44 (1903).
Herminium elizabethae (Duthie) T. Tang & F.T. Wang in Bull. Fan Mem. Inst. Biol. 7: 129 (1936).

Plant sometimes epiphytic, 15–40cm tall; tuber ovoid-ellipsoid, rugulose, 1.5–2 × 0.4–0.7cm. *Stem* erect, glabrous, leaves basal, bracteate above, 9.5–16cm long; basal sheath 1, borne 7cm up stem, narrowly lanceolate, long-acuminate, 1.4 × 0.2cm (at base); stem bracts lanceolate, acuminate, 1.5–2.5cm long. *Leaves* 2 or 3, thin, lanceolate to linear-lanceolate, acute, sheathing at base, 6–9.5 × 0.5–1.5cm; sheaths clasping, overlapping, 1–1.5cm long. *Inflorescence* laxly 8- to many-flowered; rachis glabrous, 5.5–14cm long; floral bracts lanceolate, long-acuminate, 6–9 × 1.3–1.6mm. *Flowers* 2–3mm across, uniformly green; pedicel and ovary straight to curved, tapering apically, glabrous, 5–8mm long. *Dorsal sepal* ovate to ovate-elliptic, obtuse, apical margin glandular, 1-veined, forming a hood with petals over the column, 1.5–3.5 × 1.5–2.2mm; *lateral sepals* elliptic-ovate, weakly falcate, obtuse, apical margin glandular, 1-veined, 1.8–4.2 × 0.8–2.2mm. *Petals* rotund to subquadrate, truncate, 1.8–2.8 × 0.8–2.8mm. *Lip* deeply 3-lobed, spurred, clawed at base, 2–4 × 1.8–2.2mm; lateral lobes narrowly triangular to linear, acuminate, 2mm long; mid-lobe narrowly oblong, obtuse, 2mm long; *spur* conical, straight, 1.2–2.5 × 0.6–0.8mm. *Column* 1–1.5mm tall; anther locules parallel; pollinia obovate, 1mm long; caudicle short; viscidium oval; stigma arms clavate. **Fig. 46.**

Bhutan: C – Thimphu district (Telecommunications Dish E of Thimphu, above Thimphu Hospital); N – Upper Mo Chu district (Laya); **Darjeeling** (Phalut to Ramman); **Chumbi** (Yatung to Trakarpo). On rocky bank in *Rhododendron* forest, on oak trees; 2700–3950m. July–August.

GENERAL DISTRIBUTION. NW India, Nepal, NE India and China.

ETYMOLOGY. Named after Lady Elizabeth Babington-Smith, who was interested in the botany of Simla during the Viceroyalty of Lord Elgin, her father.

4. P. fallax Lindl., Gen. Sp. Orchid. Pl.: 298 (1835). Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 7412 (holo. K-LINDL!, iso. K-W!).
Herminium fallax Lindl. in Wall. Cat.: 7412 (1832), nom. nud.
H. fallax (Lindl.) Hook. f., Fl. Brit. India 6(1): 129 (1890); Icon. Pl. 22, ser.4(2): t.2198 (1894).
Habenaria fallax (Lindl.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 325, t.428 (1898).
Platanthera fallax (Lindl.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 111 (1919).

Plant 24–35cm tall; tuber small, ellipsoid, 1.5 × 1cm. *Stem* erect, glabrous, leaf borne about the middle, bracteate above, 14–17cm long; basal sheaths 2, tubular, overlapping, 3.5–5cm long; stem bract 1, lanceolate, acuminate-caudate, 1.5–2.3 × 0.2–0.3cm. *Leaf* 1 (occasionally 2 in W Himalaya), linear to linear-lanceolate, acute, narrowed and sheathing at base, 9–15 × 0.4–1.5cm; sheaths clasping, 2–3cm long. *Inflorescence* laxly few- to many-flowered; rachis glabrous, 2.5–10cm long; floral bracts linear-lanceolate, acuminate to subcaudate, 1-veined, 0.5–1 × 0.12–0.2cm. *Flowers* 3–4mm across, uniformly green; pedicel and ovary slender, decurved, 4–5mm long. *Dorsal sepal* oblong to ovate-lanceolate, obtuse, 1-veined, forming hood with petals, 3–3.2 × 1–1.8mm; *lateral sepals* similar, ± spreading. *Petals* oblong, obtuse, weakly falcate, 2–3 × 0.5–0.8mm. *Lip* 3-lobed, spurred, fleshy; base truncate, shortly clawed, 2–3 × 1.5–2.5mm (when spread); lateral lobes divergent, oblong, obtuse, 0.8 × 0.5mm; mid-lobe broadly oblong-ovate, rounded, 1.5 × 0.8mm; *spur* weakly 2-lobed at apex, subglobose to clavate, 0.8–1mm long. *Column* 0.8–1mm tall; anther locules parallel (lacking tubes), 0.8–1mm long; pollinia clavate; caudicles short; viscidia small, cordate; staminodes small; stigmas 2, transversely oblong.

Bhutan: C – Thimphu (below Pajoding, E of Thimphu), Bumthang (Lami Gompa) and Mongar (Saling, Sengor) districts; N – Upper Mo Chu (Rodochu) and Upper Pho Chu (Thanza) districts;

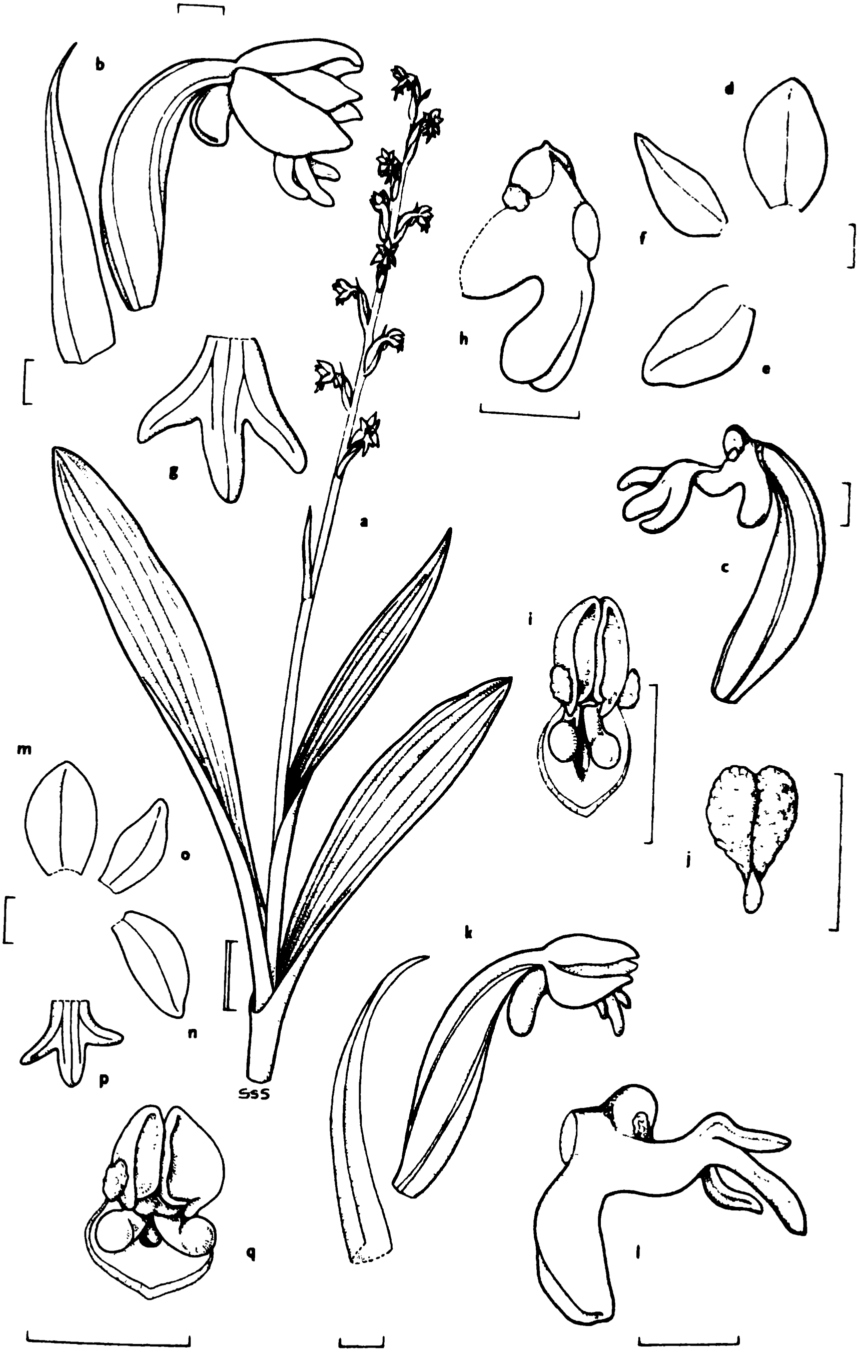


Fig. 46. **Peristylis elizabethae**: a, habit; b, flower with bract; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal, g, lip; h, spur (detail); i, column; j, pollinarium; k, flower with bract; l, lip and column (side view); m, dorsal sepal; n, lateral sepal; o, petal; p, lip; q, column. Drawn by Susanna Stuart-Smith, a–j from *Sargent* 115 (E); k–q from *Mackinnon* 22990 (K).

Sikkim (Lachen Valley, Lachung); **Chumbi** (Chubitang to Yatung). In open grassland, on grassy bank under *Picea spinulosa*; 2130–4000m. Fl. May–August.

GENERAL DISTRIBUTION. NW India, Nepal, NE India and China.
ETYMOLOGY. From the Latin *fallax* (deceptive), presumable a reference to its similarity to the closely realated genus *Herminium*.

5. **P. goodyeroides** (D. Don) Lindl., Gen. Sp. Orchid. Pl.: 299 (1835). Type: Nepal, Puspulnath, coll. *Wallich* Wall. Cat. 7066A p.p. (lecto. CAL, isolecto. BM! K-LINDL! K-W! designated by Prain in King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 327 (1898)).
Habenaria goodyeroides D. Don, Prodr. Fl. Nepal: 25 (1825).
Herminium goodyeroides (D. Don) Lindl. in Wall. Cat.: 7066 (1832), nom. nud.; Bot. Reg. 18: sub t.1499 (1832).
Platanthera goodyeroides (D. Don) Vidal, Phan. Cuming. Philipp.: 15 (1885).
Peristylus sphaerocephalon T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 64 (1951). Type: China. Yunnan, *T. Tang & F.T. Wang* 2390 (holo. PE).

Plant 35–60cm tall; *tubers* ellipsoid to cylindric, pubescent, 4.5–5 × 1.6–1.8cm. *Stem* erect, bearing leaves about middle, bracteate above, 32–44cm tall; basal sheaths 3 or 4, tubular, 3–7.5cm long, mouth wide; stem bracts lanceolate, 1.6–2.5 × 0.1–0.4cm. *Leaves* 3 or 4, clustered, ovate to ovate-elliptic, acute, narrowed and shortly sheathing at base, 5.5–12.5 × 3–6.3cm; sheaths 2–5cm long. *Inflorescence* densely to subdensely many-flowered; rachis glabrous, 9.8–23cm long; floral bracts lanceolate, acuminate, 1-veined, 1.1–1.7 × 0.2–0.4cm. *Flowers* sweetly fragrant, 5–8mm across, uniformly white or cream, sepals tinged brown; pedicel and ovary twisted, 0.8–1cm long. *Dorsal sepal* broadly ovate-lanceolate, apiculate, concave, forming hood with petals, 1-veined, 5–5.5 × 1.5–2mm; *lateral sepals* oblong, apiculate, 1-veined, 4.5–6 × 1–1.4mm. *Petals* rhombic, obtuse, 3–4.2 × 3–4.4mm. *Lip* 3-lobed, spurred, broadly triangular to subquadrate, 4.5–5 × 3.5–4mm; base broadly quadrate; lateral lobes linear-oblong, falcate, diverging, 2mm long; mid-lobe tapering to obtuse apex; spur short, subglobose, saccate, spur orifice minute, 1.8–2 × 1.8–2mm. *Column* broad, 2–2.5mm tall; anther locules parallel; pollinia pyriform; caudicles short; viscidia small, obovoid; staminodes large; stigmas 2, beneath staminodes. *Fruit* erect, sessile, ovoid, ridged, 0.7–1 × 0.2–0.35cm.

Bhutan: C – Punakha (Chusom, Rimchu) and Mongar (Reb La) districts; **Darjeeling** (Kalimpong, Nagri); **Sikkim** (Tista River). At forest margins, on open hillsides; 1000–2830m. Fl. June–July.

GENERAL DISTRIBUTION. NW Himalaya to China, SE Asia, the Philippines, Malaysia, Indonesia and New Guinea.
ETYMOLOGY. Named after the orchid genus *Goodyera* with the Greek suffix *-oides* (suggesting a resemblance).
NOTE. Seidenfaden (1977a) reviewed the taxonomy of this species.

6. **P. hamiltonianus** Lindl., Gen. Sp. Orchid. Pl.: 299 (1833). Type: Nepal, Mt. Morang, coll. *Buchanan-Hamilton* Wall. Cat. 7069 (holo. K-LINDL!, iso. K-W!).
Herminium hamiltonianum Lindl. in Wall. Cat.: 7069 (1832), nom. nud.
Habenaria hamiltoniana (Lindl.) Hook. f., Fl. Brit. India 6(1): 160 (1890).

Plant 15–30cm tall; *tuber* globose to cylindric, 1.1 × 0.8cm; *roots* lateral, above tuber. *Stem* erect, bearing bladeless sheaths in lower half and leaves about the middle, bracteate above, 10–22cm tall; basal sheaths overlapping, tubular, 1.5–5cm long (the upper larger), mouth wide; stem bract 1, linear-lanceolate, acuminate, margins minutely glandular, 2–2.8cm long. *Leaves* 4–7, lanceolate, acuminate, sheathing at base, 5.5–16 × 0.8–1.8cm; sheaths clasping stem, 1.5–4.5cm long. *Inflorescence* cylindric, densely many-fowered; rachis glabrous, 3–11cm long; floral bracts linear-lanceolate, long caudate-setaceous, 0.8–1.8 × 0.08–2cm. *Flowers* 3–5mm across, colour not known; *pedicel and ovary* twisted, 5–7mm long. *Dorsal sepal* oblong to oblong-lanceolate, obtuse, erect, 1-veined, 2–3 × 0.8–1.5mm; *lateral sepals* similar, 1-veined, 2–3 × 0.8–1mm. *Petals* broadly oblong, obtuse, partially adnate to lip, 3-veined, 2–3 × 1–1.7mm. *Lip* small, 3-lobed, spurred, broadly orbicular to wedge-shaped, lobules ovate-orbicular, margin entire, 0.8–1.5 × 1–2mm; *spur* saccate, globose, 1–1.5 × 0.9–1.3mm. *Column* 0.4–0.6mm tall; anther locules parallel; stigmatic processes large, clavate.

Darjeeling (unlocalised Griffith specimen). 1500–2000m; Fl. August.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. Named after Francis Buchanan-Hamilton (1762–1829), Superintendent of the Calcutta Botanic Garden, who made the type collection.
NOTE. This species is closely related to *P. lawii* Wight but that species has a lip equalling the sepals. The differences are small and further field studies may show them to be conspecific.

7. **P. lacertiferus** (Lindl.) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.3, 9: 23 (1927). Type: Myanmar (Burma), Tavoy, coll. *W. Gomez* Wall. Cat. 7055 (holo. K-LINDL!, iso. K-W! K!).
Coeloglossum lacertiferum Lindl., Gen. Sp. Orchid. Pl.: 302 (1835).
C. acuminatum Lindl., loc. cit. (1835). Type: Nepal, *Wallich* s.n. (holo. K-LINDL!).
Habenaria lacertifera (Lindl.) Bentham, Fl. Hongkong.: 326 (1861).
H. maingayi King & Pantling in J. Asiat. Soc. Bengal 66(3): 604 (1866). Type from Singapore.
H. tentaculata sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 324, t.427 (1898), non (Lindl.) Rchb. f.

Plant 26–40cm tall; *tuber* obliquely ellipsoid, 0.6–1.2cm long. *Stem* with sub-basal leaves, bracteate above, 17–30cm long; stem bracts linear-lanceolate, acuminate, clasping, 1–2 × 0.2–0.3cm. *Leaves* 2 or 3, oblong-elliptic to linear-oblong, subacute to acute, narrowed and sheathing at base, 3.5–12 × 1.5–2.4cm. *Inflorescence* narrow, laxly many-flowered; rachis glabrous, 6–17cm long; floral bracts lanceolate, acuminate, 0.5–1 × 0.15–0.2cm. *Flowers* 3–4mm across, uniformly green; pedicel and ovary erect, slender, 5–9mm long. *Dorsal sepal* ovate-oblong, obtuse, forming hood with petals, 1-veined, 2.8–3.1 × 1.2–1.5mm; *lateral sepals* narrowly oblong, obtuse, erect, 1-veined, 2.5–3 × 1–1.5mm. *Petals* ovate, acute, oblique at base, 1-veined, 2.5–3 × 1–1.5mm. *Lip* 3-lobed, spurred, deflexed; base broadly oblong, with a transverse callus, 0.8–1mm long; lateral lobes linear, divergent, 1–1.2mm long; mid-lobe oblong, obtuse, 0.7–1mm long; *spur* short-stalked, ovoid, 1.5 × 0.6mm. *Column* flattened from above, 1–1.2mm tall; anther locules with short tubes; pollinia pyriform; caudicle short; viscidium oblong, dark red; staminodes large, diverging; stigmas 2, on either side of the spur orifice. *Fruit* erect, subsessile, ellipsoid, 0.8–1 × 2–2.5mm.

Darjeeling (Sivok). 305m. Fl. September.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand, Malaysia, Sumatra and the Ryukyu Islands.
ETYMOLOGY. From the Latin *lacerta* (lizard) and *-fer* (carrying), referring to the flower shape.
NOTES. King & Pantling (1898) and Bose & Bhattacharjee (1999) reported *P. tentaculatus* (Lindl.) J.J. Smith from Darjeeling and Sikkim, but from their descriptions these were misidentifications of *P. lacertiferus*. *P. tentaculatus* has a shortly clawed lip base, long-filiform lateral lobes and a globose spur. It is found in China, Myanmar and SE Asia; Seidenfaden (1977a) reviewed its taxonomy.

8. **P. nematocaulon** (Hook. f.) M.L. Banerji & P. Pradhan, Orchid. Nepal Himalaya: 106 (1984). Types: India, Sikkim, *Hooker* s.n. (syn. K!); Yakla, *Clarke* 10029 (syn. K!).
Habenaria nematocaulon Hook. f., Fl. Brit. India 6(1): 154 (1890).
H. juncea King & Pantling in J. Asiat. Soc. Bengal 65(2): 132 (1897). Type: India, Sikkim, *Pantling* 406B (holo. CAL, iso. AMES! E! L! W!).

Platanthera juncea (King & Pantling) Kränzlin, Orchid. Gen. Sp.: 1: 942 (1901).
P. nematocaulon (Hook. f.) Kränzlin, *loc. cit.* (1901).

Plant 11–30cm tall; *tuber* cylindric-fusiform, pubescent, 1.5–2 × 0.5–0.7cm. *Stem* erect, slender, leaves sub-basal, bracteate to ebracteate above, 6–17cm long; basal sheath 1, tubular, 1–1.5cm long; stem bracts (0–)1–2, linear-lanceolate, acute, 0.7–1.3 × 0.15–0.2cm. *Leaf* 1 (occasionally a second further up stem), oblong to oblong-elliptic, subacute, sessile, sheathing at base, 1.4–4.5 × 0.7–1.8cm; sheath clasping, 0.5–1.5cm. *Inflorescence* laxly 7- to 12-flowered; rachis glabrous, 3.5–9cm long; floral bracts lanceolate, subacute to obtuse, 4–6 × 1–1.6mm. *Flowers* 2–3mm across, uniformly white to pale green; pedicel and ovary glabrous, cylindric, erect, 6–9mm long. *Dorsal sepal* ovate-lanceolate, acute, 1-veined, erect, 1.5–2.2 × 0.7–1mm; *lateral sepals* similar, erect. *Petals* ovate-triangular, acute, 1-veined, 1.5–2 × 0.7–1mm. *Lip* simple, spurred, oblong-lanceolate, obtuse, 5-veined, 1.5–2.2 × 0.7–1mm; *spur* clavate, contracted at base, 1–1.4 × 0.4–0.5mm (across apex). *Column* 0.6–0.8mm tall; anther locules parallel; pollinia elliptic; caudicles attenuate; viscidia large; rostellum erect, fleshy; stigma arms globose. *Fruit* sessile, erect, fusiform, beaked, 4–8 × 1–2.5mm.

Bhutan: C – Ha/Thimphu (Saga La), Thimphu (between Barshong and Dotena), Bumthang (Lami Gompa) and Mongar (Khoma) districts; **Darjeeling** (Phalut, Ramman, Sandakphu, Tonglu to Sandakphu); **Sikkim** (Lachen Valley, Nathang, Singalila Range, Yakla). On moist alpine slopes with *Kobresia* spp.; in *Rhododendron*/*Abies* forest in shade; 2740–3660m. Fl. June–August; Fr. October.

GENERAL DISTRIBUTION. Nepal, NE India and China.

ETYMOLOGY. From the Greek *nema* (a slender thread) and *caulos* (stem) in reference to the slender stem.

9. **P. parishii** Rchb. f. in Trans. Linn. Soc. London 30: 139 (1874). Type: Myanmar (Burma), Moulmein, *Parish* 216 (holo. K!).

Habenaria parishii (Rchb. f.) Hook. f., Fl. Brit. India 6(1): 161 (1890).

Plant erect, 40–70cm tall; *tuber* ellipsoid, pubescent, 4–4.5 × 1.4–2.3cm; roots fibrous, thick, arising above tuber. *Stem* with leaves clusterd around middle, bracteate above, 21–30cm tall; basal sheaths overlapping, lax, 4–5.5cm long, mouth wide; stem bracts linear-lanceolate, long-acuminate, 1.8–2 × 0.2–0.3cm. *Leaves* 4 or 5, ovate-elliptic, acute, narrowed to a short petiole and sheathing at base, 8–13 × 3.4–5.5cm; petioles channelled, 0.5–1.5cm long; sheaths 1–2cm long. *Inflorescence* subdensely to laxly many-flowered; rachis glabrous, 5–19cm long; floral bracts lanceolate, acuminate, 0.8–1.3 × 0.15–0.2cm. *Flowers* 4–5mm across; sepals brown tinged with olive-green, petals and lip olive-green; pedicel and ovary narrow, 5–7mm long. *Dorsal sepal* lanceolate to oblong-lanceolate, obtuse, 1-veined, 3–3.7 × 1.3–1.5mm; *lateral sepals* narrowly oblong, obtuse, spreading, 1-veined, 3–3.5 × 0.7–0.8mm. *Petals* broadly ovate, subacute, 1-veined, 2.5–3 × 1.5–2mm. *Lip* 3-lobed, spurred, sigmoid; base broadly clawed, subquadrate, 0.7–1.2 × 0.8–1mm; lateral lobes triangular to shortly oblong, obtuse, 0.8–1.1 × 0.2–0.25mm; mid-lobe oblong, tapering, obtuse, exceeding the lateral lobes, 1.3–1.5 × 0.4–0.5mm; *spur* straight, fusiform, 1.5–2.2mm long. *Column* 0.8–1.1mm long; anther locules parallel, close; pollinia pyriform; caudicles short; viscidia oblong; staminodes large, rugulose; stigmas 2, oblong. *Fruit* sessile, ovoid, ridged, erect, 0.7–1.2 × 0.2–0.3cm.

Darjeeling (Sivok); **Sikkim** (unlocalised *Pantling* specimen). In tropical valleys; 610m. Fl. June–July; Fr. May.

GENERAL DISTRIBUTION. India (Deccan), Nepal, Myanmar, the Andaman Islands, China, Thailand and Vietnam.

ETYMOLOGY. Named after the Rev Charles Samuel Pollock Parish (1822–1897), a British Army chaplain who collected the type material.

10. P. prainii (Hook. f.) Kränzlin, Orchid. Gen. Sp.: 514 (1901). Type: India, Naga Hills, Kohima, *Prain* 42 (holo. K!).
Habenaria prainii Hook. f., Fl. Brit. India 6(1): 159 (1890).

Plant 30–40cm tall; *tuber* narrowly fusiform, 1.5 × 0.6cm. *Stem* slender, leaves distant, bracteate above, 23–30cm tall; basal sheaths 2 or 3, tubular, overlapping, 1.5–4cm long; stem bracts 2, linear-lanceolate, acuminate, 1.2–1.3 × 0.18–0.22cm. *Leaves* 4, oblong to ovate-oblong, acute, sessile, sheathing at base, 1.8–5 × 0.8–1.8cm; sheaths clasping, 2.5–4cm long. *Inflorescence* laxly to subdensely many-flowered; rachis glabrous, 5–11cm long; floral bracts linear-lanceolate to lanceolate, acuminate, 0.7–1 × 0.15–0.2cm. *Flowers* 3–4mm across, uniformly brownish-green; pedicel and ovary glabrous, cylindric, 6–7mm long. *Dorsal sepal* ovate, obtuse, 1-veined, 2–2.5 × 0.8–1mm; *lateral sepals* linear-oblong, obtuse, 1-veined, 2–2.2 × 0.6–0.8mm. *Petals* broadly ovate, fleshy, obtuse to apiculate, 2–2.5 × 1–1.2mm. *Lip* 3-lobed, spurred, base broadly clawed, 2 × 2mm (across base); lateral lobes oblong, falcate, obtuse, 0.5–0.8mm long; mid-lobe triangular, obtuse, 0.8–1mm long; *spur* globose, 0.5–0.8 × 0.5–0.8mm. *Column* 0.6–0.8mm tall; anther locules parallel; stigmatic processes long, 0.6–0.8mm long; rostellum minute, 3-lobed.

Bhutan: (unlocalised Griffith specimen); **Darjeeling** (Mungpo). 1000m. Fl. July.

GENERAL DISTRIBUTION. NE India, Myanmar, Thailand to Vietnam.
ETYMOLOGY. Named after Sir David Prain (1857–1944), Director of the Royal Botanic Garden, Calcutta between 1857 and 1905 and the collector of the type specimen.

11. P. pseudophrys (King & Pantling) Kränzlin, Orchid. Gen. Sp. 1: 925 (1901).Type: India, Sikkim, Chungthang, *Pantling* 424 (holo. CAL).
Habenaria pseudophrys King & Pantling in J. Asiat. Soc. Bengal 65(2): 133 (1896).

Plant 45–75cm tall; *tuber* irregularly cylindric, pubescent. *Stem* bracteate above; basal sheaths 3 or 4, convolute, acuminate, 2.6–3.8cm long; stem bracts lanceolate, acuminate, 1.3–2cm long. *Leaves* 4, scattered, distant, elliptic-oblong, acute, broadly sheathing at base, 5–7.5cm long. *Inflorescence* racemose, subdensely up to 25-flowered; rachis 7–10cm long; floral bracts lanceolate, equal to or exceeding the ovary. *Flowers* 3–4mm across; pedicel and ovary sesile, shortly beaked. *Dorsal sepal* broadly elliptic or oblong, subacute; *lateral sepals* oblong, subacute, connivent with petals and lip. *Petals* elliptic, subacute, base oblique, shorter than the sepals. *Lip* 3-lobed, spurred, oblong, concave, margins entire; lateral lobes narrowly triangular, porrect; mid-lobe small, triangular, obtuse; *spur* small, globose, slightly compressed vertically. *Column* broad, 2-winged; anther locules parallel; pollinia broadly ovoid; caudicles short; viscidium discoid, surrounded by a distinct bursicle; stigma large.

Sikkim (Chungthang (King & Pantling, 1898)). 1800m. Fl. July.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Greek *pseudo-* (false), and the orchid genus *Ophrys*.
NOTES. Jain & Mehrotra (1984) considered that this species might have become extinct. We have seen no material of the species and the description is based upon King & Pantling (1898). The species is close to *P. prainii* but, according to King and Pantling, differs in having distinct *Ophrys*-like bursicles.

12. P. superanthus J.J. Wood in Kew Bull. 41(4): 811 (1986). Type: Nepal, Sankhuwasabha district, Sundanda, *Grey-Wilson et al.* 4104 (holo. K!, iso. E!).
Habenaria nematocaulon sensu King & Pantling in Ann. Roy. Bot. Gard. (Calutta) 8: 316, t.416 (1898), non (Hook. f.) M.L. Banerji & P. Pradhan.

Plant (6–)10–25cm tall; *tubers* entire or 2- to 3-lobed, cylindric, 1–2cm long. *Stem* slender; basal sheath tubular, 1–1.5cm long. *Leaves* 3 or 4, narrowly elliptic, oblong-elliptic to ovate, obtuse to acute, sessile and sheathing at base; lowest leaf 2–3.5 × 1–1.5(–2)cm; upper leaves becoming smaller and bracteate upwards, ovate-elliptic to linear, acute, sessile, 0.5–2cm long. *Inflorescence* cylindric, densely few- to many-flowered; rachis 1–2.5cm long; floral bracts ovate-elliptic to linear, acute, 3–5mm long. *Flowers* non-resupinate, uniformly white to pale pink; pedicel and ovary twisted, sessile, 2–4mm long. *Dorsal sepal* oblong-elliptic to linear-lanceolate, obtuse, 1-veined, 2.5–4 × 0.8–1mm; *lateral sepals* similar, connivent. *Petals* ovate, weakly falcate, shortly caudate to obtuse, fleshy, 1-veined, 2.5–4 × 1.5–2mm. *Lip* simple, entire, spurred, oblong, apex fleshy, obtuse, 3-veined, 3–4 × 0.5–0.8mm; *spur* ovoid, obtuse, gently curved, 0.8–2mm long. *Column* c.1mm long; anther locules short, broad, parallel, lacking thecae; stigmas partially adnate to lip base; pollinia 2, narrowly elliptic, grooved; caudicles attenuate; viscidia obliquely elliptic.

Sikkim (Gangtok, Singalila Range); **Chumbi** (Punkabeeseemoo?). In alpine meadows and *Rhododendron* forest; 3050–3350m. Fl. July–August.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Latin *super-* (above) and *-anthus* (flower, latinised from the Greek) in reference to the superior lip.

13. **P. tipuliferus** (Parish & Rchb. f.) Mukerjee in Notes Roy. Bot. Gard. Edinburgh 21: 158 (1953). Type: Myanmar (Burma), Moulmein, *Parish* 232 (holo. W! Herb. no. 1788, iso. K!).
Habenaria tipulifera Parish & Rchb. f. in Trans. Linn. Soc. London 30: 139 (1874).
H. brandisii Hook. f., Fl. Brit. India 6(1): 162 (1890). Type: Myanmar, Pegu, *Brandis* (holo. CAL, icon. K!).
H. aristata sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 312 (1898), *non* (Lindl.) Hook. f.
Peristylus brandisii (Hook. f.) Kränzlin, Orchid. Gen. Sp.: 506 (1901).

Plant 30–60cm tall; *tuber* cylindric to ovoid, 1–1.8 × 0.8–1cm. *Stem* erect, leaves clustered about middle, bracteate above; basal sheaths overlapping, tubular, 1.2–6cm long (smallest at base); stem bracts linear-lanceolate, acuminate, 1.5–2.5 × 0.15–0.25cm. *Leaves* 4–5(–6), linear-oblong to narrowly oblong, acuminate, subsessile, sheathing at base, 9–15 × 1.4–2cm; sheaths clasping, 2.5–3cm long. *Inflorescence* laxly many-flowered; rachis glabrous, 8–20cm long; floral bracts linear-lanceolate, acuminate, 0.5–1 × 0.8–1.2mm. *Flowers* 2–3mm across, uniformly greenish-yellow; pedicel and ovary narrow, glabrous, 0.6–1cm long. *Dorsal sepal* ovate, obtuse, 1-veined, erect, 3.5–4 × 1–1.2mm; *lateral sepals* wedge-shaped or oblong, obtuse to subacute, 1-veined, 3.2–3.8 × 0.7–1mm. *Petals* erect, oblong, falcate, obtuse, 1-veined, 3.5–4 × 0.8–1mm. *Lip* 3-veined, spurred, shortly clawed at base; lateral lobes divaricate, elongate-filiform, caudate-setaceous, 10–13 × 0.1–0.2mm; mid-lobe lanceolate, porrect, 1.5–2 × 0.4–0.5mm; *spur* clavate to globose (at apex), curved, 2.5–3 × 1–2mm (across apex). *Column* 1–1.5mm tall; anther locules minute, parallel; pollinia clavate; caudicles short; viscidia oblong; stigmatic processes projecting to base of lip; rostellum broad, plicate.

Darjeeling (Pasting); **Sikkim** (Chunthang, near Lingmo, Tumlang). In semi-shade in deciduous forest; on slopes among grasses and bamboo; 1000–2000m. Fl. May–July.

GENERAL DISTRIBUTION. Nepal, NE India and Myanmar.
ETYMOLOGY. From *Tipula* (an insect of the Family Tipulidae which includes the crane-flies) and *-fer* (carrying) a reference to the flower shape.
NOTES. King & Pantling (1898) described *P. aristatus* Lindl. from Sikkim. Seidenfaden (1977a) discussed its status and concluded that the King & Pantling specimen had been misidentified and should be treated as *P. tipulifera*. We follow this position here.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

P. densus (Lindl.) Santapau & Kapadia in J. Bombay Nat. Hist. Soc. 57: 128 (1960). Type: ?India, Mt. Silhet, coll. F. De Silva Wall. Cat. 7057 (holo. K-LINDL!, iso. K-W!).
Coeloglossum densum Lindl., Gen. Sp. Orchid. Pl.: 302 (1832).

NOTES. Reported by Pradhan (1976) and Bose & Bhattacharjee (1999) from Sikkim. It is related to *P. richardianus* in having leaves distributed along the stem and lateral lobes of the lip exceeding the mid-lobe, but it has a cylindric, rather than globose, spur. *P. densus* is common in the Khasia Hills, but we have seen no specimens from our area.

P. richardianus Wight, Icon. Pl. Ind. Orient. 5(1): 12, t.1697 (1851). Type: India, Nilgiri Hills, *Richard* s.n. (holo. P?).

Habenaria bicornuta Hook. f., Fl. Brit. India 6(1): 156 (1890). Type: India, Nilgiri Hills, *Wight* s.n. (holo. K!).

NOTE. Reported by Joseph & Abbareddy (1980) from the Kameng district of Arunachal Pradesh.

46. Platanthera L.C. Richard

Plants small to medium in size, terrestrial or sometimes epiphytic; rootstock tuberous or of a fascicle of fleshy, tapered roots; *tuber* entire, fusiform or ovoid. *Stem* erect, with basal, bladeless sheaths, leafy or not. *Leaves* basal or cauline. *Inflorescence* terminal, racemose, laxly to densely flowered; floral bracts leaf-like. *Flowers* small to medium-sized, often fragrant; ovary cylindric to fusiform, curved, twisted, glabrous. *Dorsal sepal* and *petals* usually connivent to form a hood; *lateral sepals* free, spreading or recurved. *Lip* entire or lobed, spurred; *spur* variable, filiform, cylindric or clavate. *Column* short, truncate; rostellum flattened, triangular with a rudimentary median lobe; anther broad, immobile, locules separated, divergent or convergent and parallel; pollinia 2, clavate or cleft into 2 halves; caudicles attached to naked viscidia (bursicles absent); stigma variable, either 2, distinct and lateral or conjoined above or below the spur orifice.

The genus *Platanthera* was established in 1818 by Louis-Claude-Marie Richard in the *Mémoires du Muséum d'Histoire Naturelle* to accommodate those European orchids that fall between *Orchis* and *Habenaria*. The genus comprises about 100 species distributed widely in the temperate regions of both hemispheres.

Platanthera is closely related to *Habenaria* and has been treated as congeneric by some authors. Hooker (1890) did not recognise *Platanthera* as a distinct genus treating the species under section *Hologlossa* of *Habenaria*. He recognised two groups, one with a leafy stem, the other with a solitary leaf at or below the middle of the stem. Pfitzer (1889) treated *Platanthera* as a distinct genus and proposed two sections: *Filicornes* (with a slender, long spur) and *Crassicornes* (with a stout, short spur). Inoue & Lin (1980) argued that because of its variability, spur shape was not an appropriate character on which to base sections. They proposed three sections based partly upon the structure of the sinker (the subterranean organ which initiates a new shoot): *Brevicalcarata* (sinker stoloniferous, viscidium naked, lip entire), *Tulotis* (sinker stoloniferous, viscidium contained in pouches, lip with lateral lobes) and *Platanthera* (sinker fusiform, lip entire). None of these proposals is satisfactory.

Lang (1988) proposed *Stigmatosae* as a new subgenus of *Platanthera*. Subgenus *Platanthera* has sepals with entire margins and a single stigma that is concave under the rostellum, while subgenus *Stigmatosae* has ciliate sepal margins and (1 or) 2 convex stigmas.

The pollination syndrome was discussed by van der Cingel (1995) and is based upon Lepidopteran and mosquito vectors. These are scaly or hairy insects which have led to the evolution of two column types. One is large with widely separated viscidia and long-caudicled pollinia, the other is narrower and small with close viscidia and short-caudicled pollinia. Nilsson (1983b) has summarised the data on the pollinators of the European species *P. bifolia* (L.) L.C. Richard and *P. chlorantha* (Custer) Rchb.

TYPE. *Platanthera bifolia* (L.) L.C. Richard, *nom. cons.*; basionym: *Orchis bifolia* L.
ETYMOLOGY. From the Greek *platy-* (broad) and *anthera* (anther) in reference to the unusual width of the anther.

Key to species

1. Leaf 1 (with or without leafy bracts above) 2
+ Leaves more than 2 5

2. Stem naked above leaf .... **9. P. exelliana**
+ Stem with prominent leafy bracts above the leaf 3

3. Spur more than 3cm long .... **1. P. arcuata**
+ Spur less than 1.4cm long 4

4. Leaf linear-oblong; leafy bracts linear-lanceolate, small below rachis; spur more than 7mm long .... **11. P. leptocaulon**
+ Leaf ovate; leafy bracts broadly lanceolate, large below rachis; spur less than 5mm long **12. P. pachycaulon**

5. Spur shorter than or equalling the sepals and shorter than the ovary; lip base with small but distinct lateral lobes .... **4. P. biermanniana**
+ Spur much longer than the sepals; lip entire 6

6. Sepals not ciliate 7
+ Sepals ciliate 10

7. Plant more than 30cm tall; floral bracts less than 1.6cm long 8
+ Plant less than 20cm tall; floral bracts more than 2.2cm long 9

8. Caudicles absent; stigma inserted below the spur opening .... **2. P. bakeriana**
+ Caudicles long; stigma inserted above the spur opening .... **14. P. stenantha**

9. Leaves 3 or more, less than 1.5cm long .... **7. P. dyeriana**
+ Leaves 2, more than 4cm long .... **13. P. sikkimensis**

10. Leaf margin undulate 11
+ Leaf margin not undulate 12

11. Plant more than 30cm tall .... **3. P. bhutanica**
+ Plant less than 12cm tall .... **6. P. cumminsiana**

12. Spur less than 0.6cm long .... **5. P. clavigera**
+ Spur more than 1cm long 13

13. Spur curved and hooked forwards; lateral sepals pubescent .... **8. P. edgeworthii**
+ Spur curved backwards, not hooked; lateral sepals not pubescent .... **10. P. latilabris**

1. P. arcuata Lindl., Gen. Sp. Orchid. Pl.: 289 (1833). Type: India, Mussooree, *Royle* s.n. (holo. LIV!).
Habenaria arcuata (Lindl.) Hook. f., Fl. Brit. India 6(1): 155 (1890).
H. davidsonii sensu Gupta, Fl. Nainital.: 354 (1968), non Franchet.

Plant 40–50cm tall. *Stem* 5–6mm wide, with large, leaf-like bracts above; stem bracts lanceolate, acuminate, shortly sheathing, 4–6.5 × 0.8–1.7cm. *Leaf* 1, oblong to oblong-elliptic, acute, sessile, sheathing at base, surface weakly reticulate, 10.5 × 3.5–4cm; sheath 4–6cm long. *Inflorescence* laxly many-flowered; rachis glabrous, 12–17cm long; floral bracts linear-lanceolate, acuminate, 1.5–3.5 × 0.6–0.35cm Flowers 1–1.5cm across, uniformly white; pedicel and ovary long, glabrous, 1.8–2cm long. *Dorsal sepal* ovate, subacute, 3-veined, hooded, 8–9 × 3–3.5mm; *lateral sepals* oblong, deflexed, 6–7 × 3mm. *Petals* linear, obtuse, 1-veined, free, 6–7 × 0.8–1mm. *Lip* simple, spurred, thick, linear, obtuse, base auriculate, 0.8–1.5cm long; *spur* slender, curved, falcate, 3–6.5cm long. *Column* stout, 2–3mm tall; anther locules 1–2mm long.

Bhutan: C – Punakha (Pele La to Ritang), Tongsa (Chendebi, Rinchen Chu), Bumthang (Bumthang Chu, Khak Thang, Shabjetang) and Mongar (Reb La) districts. In dense, mixed forest, open grassy places, damp scrub, under bamboo; 2290–3050m. Fl. June–August.

GENERAL DISTRIBUTION. NW India, Nepal.

ETYMOLOGY. From the Latin *arcuatus* (curved like a bow) in reference to the spur.

NOTE. Reports of *P. japonica* (Thunberg) Lindl. from this area have been based upon misidentification of material now considered to belong to *P. arcuata*.

2. **P. bakeriana** (King & Pantling) Kränzlin, Orchid. Gen. Sp. 1: 632 (1898). Type: India, Sikkim, Lachen Valley, *Pantling* 401B (holo. CAL, iso. K!).

Habenaria bakeriana King & Pantling in J. Asiat. Soc. Bengal 65(2): 132 (1896).

Plant 30–45cm tall; *tuber* fusiform, 1.5–2cm long. *Stem* glabrous, 20–22cm long; basal sheaths convolute, subacute. *Leaves* 3–5, distant along stem, sessile; lower leaves oblong, subacute, base broadly sheathing, 7–13(–17) × 2.4–4cm; upper leaves linear-lanceolate, becoming smaller up stem, 3–4.5 × 0.4–0.5cm. *Inflorescence* laxly 6- to many-flowered; rachis glabrous, 8–12cm long; floral bracts linear-lanceolate, subacute, 0.6–3 × 0.1–0.3cm (decreasing in size upwards). *Flowers* 1cm across, uniformly green to greenish-white; pedicel and ovary glabrous, 6–9mm long. *Dorsal sepal* ovate-elliptic, base broad, subacute, connivent with petals to form a hood over the column, 4–6 × 1–3.5mm; *lateral sepals* oblong-ovate, reflexed, 4–6 × 1–2.5mm. *Petals* broadly ovate, oblique, base broad, 3–4.5 × 1–1.5mm. *Lip* entire, spurred, oblong, broadened towards base, fleshy, 4–6 × 1–1.5mm; *spur* slender, cylindric, recurved, 1.1–1.4cm long. *Column* short, stout; staminodes obovate, transverse; stigma 2-lobed, inserted below opening of spur; caudicles absent. *Fruit* cylindric, erect, appressed to rachis, 1–1.2 × 0.3–0.5cm.

Bhutan: C – Mongar district (Khoma); **N** – Upper Mo Chu district (between Gasa and Kohina); **Darjeeling** (Tonglu); **Sikkim** (Chhumapu, Lachen, Lachung Valley, Lowthang?, Nathang, Singalila, Yak La); **Chumbi** (Shari). In mixed broad-leaved forest; 2740–3350m. Fl. June–July; Fr. September–October.

GENERAL DISTRIBUTION. E Himalaya and China.

ETYMOLOGY. Named after J.G. Baker (1834–1920), Keeper of the Herbarium at the Royal Botanic Gardens, Kew between 1890 and 1899.

3. **P. bhutanica** K. Inoue in J. Jap. Bot. 61(7): 193 (1986). Type: Bhutan, Thimphu district, Parshong (Barshong), *Cooper* 2596 (holo. E!, iso. BM!).

Plant c.30cm tall; *rhizome* stoloniferous, horizontal, 2cm long; *tuber* short. *Stem* erect, 30–35cm long; basal sheaths overlapping, tubular, lanceolate, acute, 1.5–2.5cm long. *Leaves* 3, basal ones largest, elliptic, acute, margins undulate, base petiolate, sheathing, 6–6.5 × 3cm; upper leaves distant, lanceolate, 2.5–5cm long. *Inflorescence* laxly 5- or 6-flowered; rachis 8–9cm long; floral bracts lanceolate, the lower exceeding flowers, 1.2–2cm long. *Flowers* 0.9–1cm across, colour unknown; pedicel and ovary ciliate, c.1cm long. *Dorsal sepal* ovate, obtuse, margin ciliate, 3-veined, 6–7 × 5–6mm; *lateral sepals* ovate-lanceolate, oblique, obtuse, reflexed, margins ciliate, 3-veined, c.9 × 3mm. *Petals* connivent with dorsal sepal, ovate, oblique, apex wavy, acute, 3-veined, 5–7.5 × 1.5–2mm. *Lip* reflexed, simple, spurred, oblong or lanceolate, 5-veined, 1.1 × 0.3cm; *spur* curved upwards, clavate, 1.4–1.7cm long. *Column* c.3.5 × 3.5mm; pollinarium c.3.5mm long; caudicle c.2.5mm long; viscidium naked, suborbicular, c.0.4mm wide; rostellum lorate; stigma concave.

Bhutan: C – Thimphu district (Barshong); **Sikkim** (Tankra Mountain). 3350–3960m. Fl. July–August.

GENERAL DISTRIBUTION. E Himalaya.
ETYMOLOGY. From Bhutan, where the type specimen was collected.

4. **P. biermanniana** (King & Pantling) Kränzlin, Orchid. Gen. Sp. 1: 636 (1898). Type: India, Darjeeling, Senchal, *Pantling* 332 (holo. CAL, iso. K!).
Habenaria biermanniana King & Pantling in J. Asiat. Soc. Bengal 64(3): 343 (1896).

Plant terrestrial, erect, 15–26cm tall; *tuber* cylindric-ovoid, sparsely pubescent, 1.3–1.3 × 0.4–1.2cm. *Stem* slender, bracetate above leaves; basal sheaths overlapping, lanceolate, 1–1.5cm long; stem bracts lanceolate, acute to acuminate, 1.8–2.6 × 0.3–0.4cm. *Leaves* 4 or 5, distant, lanceolate, acute, clasping, strongly veined, 2–5 × 0.8–1.4cm; sheath 1.5–2.2cm long. *Inflorescence* laxly 5- to 8-flowered; rachis 4.5–7cm long; floral bracts linear-lanceolate, acuminate, 5–9 × 2–3mm. *Flowers* 3.5–4.5mm across; sepals and petals green, lip yellow-green; pedicel and ovary glabrous, 7–9mm long. *Sepals* similar, ovate-lanceolate, subacute, base oblique, forming hood with the petals, 3–4 × 1–1.5mm. *Petals* triangular-lanceolate, subacute, 2.5–3.5 × 1–1.5mm. Lip obscurely 3-lobed, fleshy, spurred, 2.5–3mm long; lateral lobes triangular, obtuse, c.0.25mm long; mid-lobe linear-oblong to linear-lanceolate, apex obtuse, decurved; *spur* curved, subclavate, dorsally compressed, 3–4mm long. *Column* short, c.1mm long; pollinia pyriform; stigmas 2, separated by spur opening.

Darjeeling (Senchal (King & Pantling, 1898), Singalila Range). In rhododendron forest; 2910–3050m. Fl. July–August.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. Named after Adolf Biermann, who was resident on the Government Cinchona Plantation at Mungpo (Darjeeling) and later Curator of the Calcutta Botanic Garden.

5. **P. clavigera** Lindl., Gen. Sp. Orchid. Pl.: 289 (1835). Type: India, Simla, *Dalhousie* s.n. (holo. K-LINDL!, iso. K! LIV!).
Habenaria densa Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 326 (1835). Type: Nepal, coll. *Wallich* Wall. Cat. 7046 p.p.(holo. K-W!).
Platanthera densa (Lindl.) Freyn. in Oesterr. Bot. Z. 46: 96 (1896).
Habenaria clavigera (Lindl.) Dandy in J. Bot. 68: 246 (1930).

Plant 30–40cm tall; *tuber* cylindric, 2.1 × 0.7cm. *Stem* erect, bracteate above; basal sheaths tubular, obtuse, 2–4cm long, mouth wide; stem bracts narrowly lanceolate, acuminate, 1.8–2 × 0.2–0.3cm. *Leaves* 3 or 4, inserted along stem, lanceolate to narrowly elliptic, acute, sessile, sheathing at base, 6–11.5 × 1.3–3.5cm; sheaths 2.5–3.5cm long. *Inflorescence* subdensely many-flowered; rachis 6.5–22cm long; floral bracts lanceolate, acuminate, margins minutely glandular-ciliate, 0.9–1.4 × 0.15–0.22cm. *Flowers* 7–8mm across, uniformly green; pedicel and ovary 5–8mm long. *Dorsal sepal* broadly elliptic-oblong, obtuse, erect, concave, margins minutely glandular-ciliate, 3-veined, 2.5–3 × 1.8–2mm; *lateral sepals* oblong-lanceolate, reflexed, 3-veined, 3–3.5 × 1.5–1.8mm. *Petals* elliptic-oblong, obtuse, base oblique, 1-veined, 2.2–3 × 1.5–1.8mm. *Lip* simple, linear, obtuse; disc with a transverse callus at base, 3.5–4 × 0.5–0.8mm; *spur* clavate, pendent, rounded, laterally compressed, 5–6 × 0.8–1.2mm (at apex). *Column* broad, 0.5–0.6mm; stigmas 2, suborbicular; anther locules 0.5–0.7mm across. *Fruit* sessile, ovoid, ridged, 8–9 × 3–4mm.

Bhutan: C – Thimphu (below Changri Monastery, Dotena, mountain E of Thimphu), Tongsa (near Shemgang) and Bumthang (Bumthang, Dhur, Lami Gompa) districts; N – Upper Mo Chu (Gasa Dzong) and Upper Kuru Chu (Denchung) districts; **Darjeeling** (Manibhanjan, below Observatory Hill, Rimbik to Budhwari); **Sikkim** (Dombang, Dzongri, Lachen, Lachung, Singalila Range, Rishi); **Chumbi**

(Chubitang, Trakarpo, Yatung). On mossy banks in *Quercus semecarpifolia* forest, scrub on open hillsides, clearing in *Picea* forest, among shrubs and small bamboo; 1520–3960m. Fl. July–October; Fr. October.

GENERAL DISTRIBUTION. NW India, Nepal, NE India and China (Xizang).
ETYMOLOGY. From the Latin *clavatus* (clavate) in reference to the spur.

6. **P. cumminsiana** (King & Pantling) Renz in Edinb. J. Bot. 58(1): 117 (2001). Type: India, Sikkim, *Pantling* 329 (holo. K!).
Habenaria cumminsiana King & Pantling in J. Asiat. Soc. Bengal 64(3): 343 (1896).

Plant 12cm tall; *tuber* cylindric. *Stem* leafy near base, somewhat flattened, glabrous, 7.5cm long; basal sheath tubular, 2.2cm long, mouth wide. *Leaves* 3 or 4, broadly elliptic to lanceolate, acute to subacute, margins weakly undulate, sessile, base sheathing, 2.4–4.5 × 0.6–1.9cm. *Inflorescence* subdensely many-flowered; rachis weakly zigzag, glabrous, 4.5cm long; floral bracts lanceolate, acute, 0.6–1.5 × 0.15–0.25cm. *Flowers* 4–6mm across, uniformly green; pedicel and ovary weakly curved, 3–5mm long. *Dorsal sepal* elliptic-ovate, obtuse, 1-veined, margins glandular-pubescent, forming hood with petals, 3 × 1.5mm; *lateral sepals* lanceolate-elliptic, oblique, obtuse, 1-veined, margins glandular-pubescent, 3.5 × 1.5mm. *Petals* triangular, obtuse, weakly falcate, base truncate, inner margin crenate (near base), fleshy, 3 × 2mm. *Lip* simple, spurred, fleshy, oblong, subcylindric, deflexed at base, surface warty, 3 × 1mm; *spur* slender, curved, pubescent internally, 8mm long. *Column* c.1mm long; pollinia cylindric, subclavate; stigmas 2, distinct, tapering. **Fig.** 47.

Sikkim (Lachung Valley). 3350–3660m. Fl. July–August.

GENERAL DISTRIBUTION. NE India (Arunachal Pradesh).
ETYMOLOGY. Named after Henry Alfred Cummins (1864–1939), who was surgeon to a detachment of troops stationed near the Tibetan frontier and a plant collector in Sikkim and 'British Bhutan'.

7. **P. dyeriana** (King & Pantling) Kränzlin, Orchid. Gen. Sp. 1: 636 (1898). Type: India, Sikkim, Lachen valley, *Pantling* 407A (holo. CAL, iso. AMES! K! L! W!).
Habenaria dyeriana King & Pantling in J. Asiat. Soc. Bengal 65(2): 133 (1896).

Plant erect, slender, 12–18cm tall; *rhizome* thickly fusiform, 2–3mm wide. *Stem* slender, 7–9cm tall; basal sheaths 1 or 2, overlapping, oblanceolate, obtuse, 1–1.5cm long. *Leaves* 3 or 4, inserted along stem, oblong-lanceolate, subacute, sessile, sheathing at base, 1.5–2.3 × 0.3–0.5cm; sheaths 5–7mm long. *Inflorescence* laxly 5- to 8-flowered; rachis 2–9cm long; floral bracts leaf-like, ovate-lanceolate, acute, largest at base of rachis, 0.6–1.5 × 0.15–0.3cm. *Flowers* 5–8mm across, uniformly green; pedicel and ovary scabrid, beaked, 0.8–1cm long. *Dorsal sepal* erect, ovate-lanceolate, base weakly cordate, obtuse, hooded, 4.5–5 × 1.5–3mm; *lateral sepals* narrowly oblong, obtuse, reflexed, 5–6 × 1.3–1.5mm. *Petals* erect, lanceolate, subacute, base oblique, inner margins weakly undulate, 5.5–6.5 × 1.4–1.8mm. *Lip* fleshy, simple, spurred, narrowly oblong-triangular, deflexed, 2-auriculate at base, margins weakly undulate, apex acutely recurved, 7–8 × 1.3–2mm (at base); *spur* slender, incurved, laterally compressed, 0.8–1cm long. *Column* broad, 1–1.2mm tall; anther cap clavate, 1.5mm long; pollinia ovoid; caudicle long, curved, 1.8–2mm long; stigma large, conjoined, transversely oblong, inserted above opening to spur, 1.8–2mm across; staminodes large.

Sikkim (Lachen, below Tangkar La). 3660m. Fl. July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Namer after Sir William Turner Thistleton-Dyer (1843–1928), Director of the Royal Botanic Gardens, Kew between 1885 and 1905.

8. **P. edgeworthii** (Hook. f. ex Collett) R.K. Gupta, Fl. Nainitalensis: 349 (1968). Type: Indian Himalaya, Simla, *Edgeworth* s.n. (holo. K!).
Habenaria edgeworthii Hook. f. ex Collett in Collett, Fl. Siml.: 504, f.166 (1902).
Habenaria acuminata sensu T.A. Rao in Bull. Bot. Surv. Ind. 2: 89 (1960), non (Thwaites) Trimen.

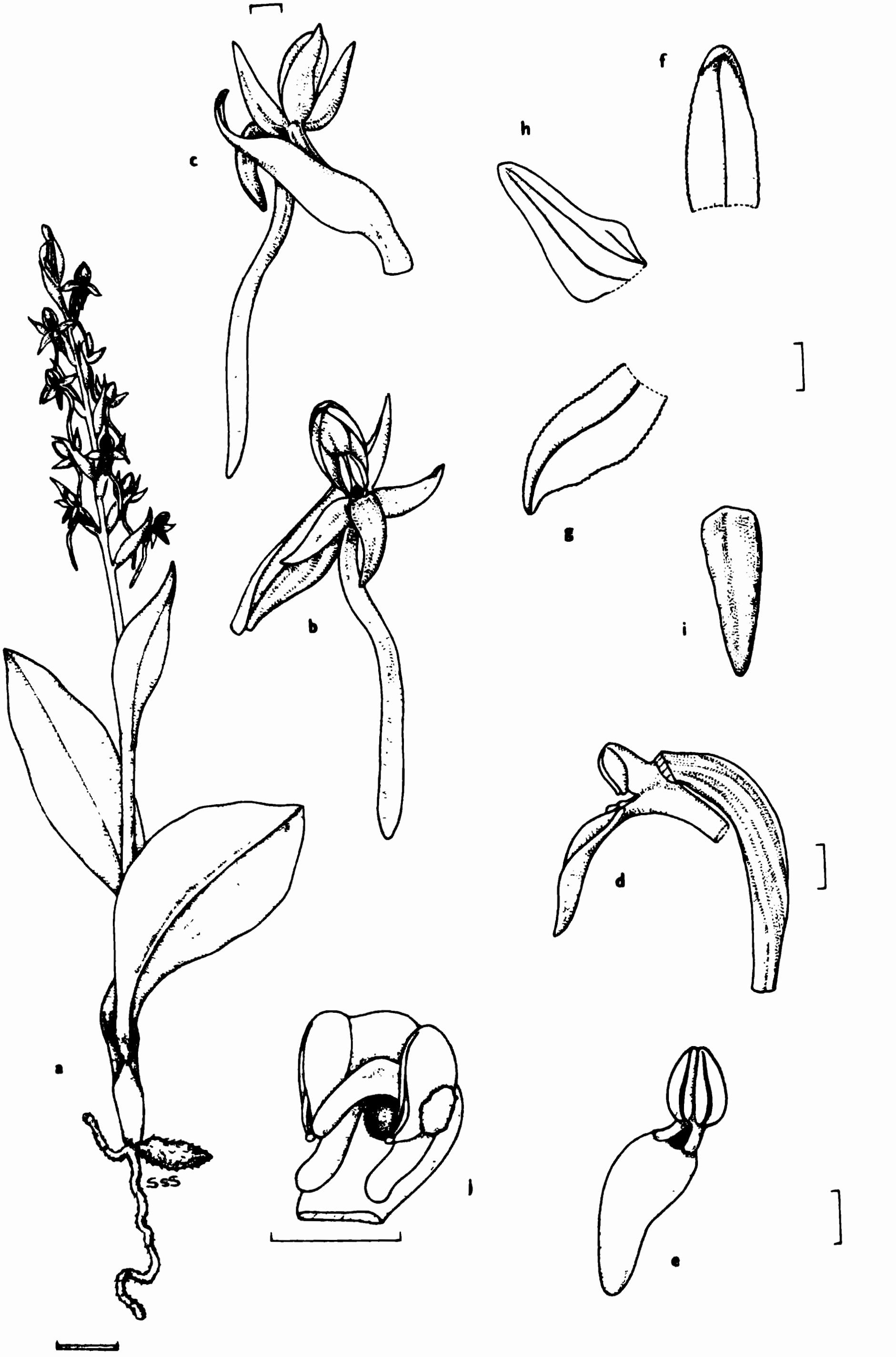


Fig. 47. **Platanthera cumminsiana**: a, habit; b, flower (front view); c, flower (back view); d, ovary, column and lip (side view with spur cut); e, lip with column; f, dorsal sepal; g, lateral sepal; h, petal; i, lip; j, column. Drawn by Susanna Stuart-Smith, a–i from *Pantling* 329 (K); j from t.424 in King & Pantling (1898).

Plant 35–50cm tall; *tubers* small, fusiform, ellipsoid to subglobose, 1–2.4 × 0.4–0.9cm. *Stem* leafy; basal sheaths tubular 3.5–4cm long. *Leaves* 3 or 4, the lower broadly ovate, becoming ovate to oblong-lanceolate up stem, bract-like above, sessile, 6–8 × 2–4.5cm; stem bracts lanceolate, acute, 1.3–2.1 × 0.3–0.4cm. *Inflorescence* cylindric, subdensely many-flowered; rachis 8–28cm long; floral bracts narrowly lanceolate, acute (becoming shorter upwards), 0.5–1.4 × 0.16–0.2cm. *Flowers* 3–5mm long; sepals green, petals yellowish to greenish-yellow, lip yellow; pedicel and ovary curved, beaked, twisted, 0.9–1.4cm long. *Dorsal sepal* broadly ovate, concave, 3-veined, margins minutely ciliate, 3.6–4.5 × 3–5mm; *lateral sepals* broadly ovate, 3-veined, margins ciliate, pubescent on external surface, 5–6 × 2–2.5mm. *Petals* lanceolate, base obliquely triangular, incurved and hooded with the dorsal sepal, 4–6 × 1–1.5mm. *Lip* simple, shortly clawed, spurred, 4–6 × 1–1.8mm; claw grooved; lamina thick, oblong (tapering towards apex), abruptly deflexed; *spur* spreading upwards, cylindric, hooked and curved forwards towards the tip, 1–1.9cm long. *Column* c.2mm long; stigma oblong; rostellum triangular.

Bhutan: C – Bumthang district (Lami Gompa); **N** –Upper Mo Chu district (Gasa Dzong); **Darjeeling** (Birch Hill Road, Ghoom, N of Manibhanjan, Peshok, between Phalut and Sandakphu); **Sikkim** (Lachen, between Singhik and Tong); **Chumbi** (Chubitang, Yatung). In scrub, on open hillside; 1220–3600m. Fl. June–September.

GENERAL DISTRIBUTION. Pakistan, NW Himalaya, Nepal, E Himalaya.

ETYMOLOGY. Named after Michael Pakenham Edgeworth (1812–1881), a British botanist and Civil Servant stationed in Bengal.

NOTE. The taxonomic history of this species can be found under P. *latilabris* from which it can be distinguished by the characteristic long slender spurs which are coiled and turned upwards.

9. **P. exelliana** Soó in Ann. Hist.-Nat. Mus. Natl. Hung. 26: 359 (1929). Type: India, Sikkim, *Hooker* 311 (holo. K-LINDL!, iso. K!).

Habenaria oligantha sensu Hook. f., Fl. Brit. India 6(1): 154 (1890), non Turczaninow (1854).

Platanthera elachyantha T. Tang & F.T. Wang in Acta. Phytotax. Sin. 1: 58 (1951), *nomen*.

Plant 16–28cm tall; *tuber* fusiform, 1.2 × 0.4cm. *Stem* slender, 14–18cm long; basal sheath tubular, 0.8–1.5cm long. *Leaf* 1 (occasionally 2), elliptic to oblong-elliptic, subacute, sessile, base shortly sheathing, 5–8 × 2–3.2cm; sheath 0.8–1cm long. *Inflorescence* laxly 8- to 15-flowered; rachis 5–10cm long; floral bracts linear-lanceolate to lanceolate, acute, becoming shorter upwards, 1.5–2.2 × 0.4–0.6cm (at base), 6–8 × 0.8–1mm (at apex). *Flowers* 5–7mm across, uniformly green; pedicel and ovary glabrous, 5–7mm long. *Dorsal sepal* oblong to oblong-lanceolate, subacute, obscurely 3-veined, margins minutely glandular-ciliate, hooded, 3.5–4 × 1.2–1.5mm; *lateral sepals* oblong-lanceolate, subacute, spreading, 3-veined, 3–4 × 1–1.5mm. *Petals* triangular-lanceolate, subacute, base of lower margins gibbous, 3.5–4 × 0.8–1mm. *Lip* simple, spurred, fleshy, linear-lanceolate, subacute, 3–3.5 × 0.8–1mm; *spur* stout, incurved, subclavate, 5–8mm long. *Column* 0.5–0.8mm long; anther locules c.1.2mm long; pollinia pyriform; caudicle short; viscidium minute; stigmas globose. *Fruit* ovoid, shortly stalked, 6–7 × 1.5–2mm.

Bhutan: C – Thimphu district (Dotena, above Pajoding); **Darjeeling** (Phalut); **Sikkim** (Bikbari, Dzongri, Jelep La, Lachung, Nathong, Nathut?, Phutung La, Tangkar Mountain, Tsomgo, Yampung, above Yumthang). In open woodland, on grassy banks, in open *Rhododendron* scrub, on yak pasture; 3050–4270m. Fl. June–September.

GENERAL DISTRIBUTION. Nepal, NE India and China.

ETYMOLOGY. Named after Arthur Wallis Exell (1901–1993), a taxonomist who worked mainly on African plants at the British Museum (Natural History).

NOTE. This species was first described by Hooker (1890) as *Habenaria oligantha* but this was a later homonym.

10. P. latilabris Lindl., Gen. Sp. Orchid. Pl.: 289 (1835). Type: India Septentrionale, Wall. Cat. 7040 p.p. (holo. K-LINDL!, iso. K-W!).

Platanthera acuminata Lindl. in Wall. Cat.: 7040 (1832) p p.; Gen. Sp. Orchid. Pl.: 289 (1835). Type: Nepal, coll. *Wallich* Wall. Cat. 7040A (syn. K-LINDL!, isosyn. K-W!); India, Kamaon, coll. R. *Blinkworth* Wall. Cat. 7040B (syn. K-LINDL!, isosyn. K-W!); India, icon. Wallich 167 (syn. K!).

Habenaria laltilabris (Lindl.) Hook. f., Fl. Brit. India 6(1): 153 (1890).

Pecteilis latilabris (Lindl.) Mitra, Fl. Pl. Eastern India 1: 276 (1958).

Plant 25–35cm tall; *tuber* fusiform, 2–3.2 × 0.6–1.3cm. *Stem* erect, 22cm long. *Leaves* 4 or 5, elliptic-oblong, acute to acuminate, broadly sheathing at base, those at middle of stem largest, with leafy bracts above, 5–12.5 × 1.8–4.5cm; sheaths 1–4cm long; stem bracts, lanceolate, acute to acuminate, 1.5–2.5 × 0.3–0.6cm. *Inflorescence* laxly 12- to many-flowered; rachis glabrous, 7–24cm long; floral bracts lanceolate, acuminate, 0.9–1.1 × 0.2–0.3cm. *Flowers* 0.8–1.1cm across; sepals green, petals and lip greenish-yellow; pedicel and ovary 0.8–1.1cm long. *Dorsal sepal* concave, broadly ovate-orbicular, margins shortly glandular-pubescent, 3-veined, 3.5–4.3 × 2.8–3.5mm; *lateral sepals* oblong-ovate to ovate-laceolate, subacute, reflexed, 3-veined, 4.4–6 × 2.2–3mm. *Petals* triangular at base, oblong-falcate above, obtuse, 1-veined, 3–4 × 0.8–1.5mm. *Lip* simple, spurred, shortly clawed at base, linear-oblong, tapering to apex, entire, 5–6 × 0.5–0.7mm; *spur* slender, cylindric, laterally compressed, curved, 1.1–1.5 × 0.6–0.7cm. *Column* 2mm long; pollinaria parallel, 2, each 2 × 0.8mm; anther locules 1–1.1mm long; stigmas 2. *Fruit* sessile, fusiform, shortly beaked.

Bhutan: C – Thimphu (mountain E of Thimphu), Tongsa (near Shemgang) and Mongar (Unjar) districts; **N** – Upper Mo Chu district (Gasa Dzong); **Darjeeling** (unlocalised Drummond collection); **Sikkim** (Lachen, Lachung, Singalila Range, between Yoksam and Dubde). Scrub on open hillsides, deciduous oak forest, clearings in *Picea* forest, shady banks in disturbed secondary forest, in mixed deciduous forest (*Alnus nepalensis* and *Quercus leucotrichophora*); 1680–3200m. Fl. July–September.

GENERAL DISTRIBUTION. NE India and China.

ETYMOLOGY. From the Latin *latilabris* (wide lip).

NOTES. Lindley based *P. latilabris* on part of *Wallich* 7040. This number includes specimens collected in Nepal by Wallich and in Kumaon by Blinkworth, and was given the name *P. acuminatum* in the Wallich Catalogue (a *nomen nudum*). Some of the specimens bearing this number are now referred to *P. edgeworthii* and the two species often grow together.

11. P. leptocaulon (Hook. f.) Soó in Ann. Hist.-Nat. Mus. Natl. Hung. 26: 360 (1929). Type: India, Sikkim, Lachen valley, *Hooker* 315 (holo. K-LINDL!, iso. K!).

Habenaria leptocaulon Hook. f., Fl. Brit. India 6(1): 154 (1890).

Platanthera silaensis Handel-Mazzetti, Symb. Sin. 7: 1331, abb.41,6 (1936). Type: China, Yunnan, *Handel-Mazzetti* 9965 (holo. WU, iso. W!).

P. leptocaulon (Hook. f.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 58 (1951), *comb. superfl.*

Plant 25–35cm tall. *Stem* slender, glabrous, bracteate above leaves, 25–30cm long; basal sheaths 2 or 3, overlapping, lanceolate, acute to acuminate, 2–3cm long; stem bracts linear-lanceolate, acuminate, unequal, the lower 3.5–6 × 0.9–1cm, the upper 1.5 × 0.2cm. *Leaf* 1, linear-oblong, acute, long-sheathed, 7–10.5 × 0.8–1.8cm; sheath 3–4cm long. *Inflorescence* laxly 3- to 8-flowered; rachis glabrous, 3.5–7cm long; floral bracts lanceolate, acute to acuminate, 1–1.2 × 0.15–0.2cm. *Flowers* 6–9mm across, uniformly green; pedicel and ovary glabrous, 6–9mm long. *Dorsal sepal* oblong-elliptic, acute, 3-veined, connivent with the petals, 4.5–5.5 × 1.5–1.6mm; *lateral sepals* oblong-elliptic, acute, reflexed, 3-veined, 4.5–5 × 1.5–1.6mm. *Petals* fleshy, lanceolate, subacute, base broadly truncate, falcate, 3-veined, 5–6 × 1.8–2mm. *Lip* simple, spurred, fleshy, oblong-lanceolate, obtuse, entire, deflexed, 4.5mm long; *spur* cylindric, subclavate, slightly curved, minutely hispid within, 0.6–1.4cm long. *Column* stout, 2mm long; pollinia elliptic, tapering; stigmas 2, broadly oblong. **Plate 6.**

Bhutan: C – Thimphu district (SE of Pajoding); **N** – Upper Mo Chu (near Laya), Upper Mangde Chu (Dur Chutsen, Worthang) and Upper Kulong Chu (Lao) districts; **Darjeeling** (Tonglu); **Sikkim** (Chuya Bhanjang, Kyangnosa La, Lachen, Lachung Valley, Singalila); **Chumbi** (Pongling?, Yatung). In mixed (*Abies*, *Larix* and *Rhododendron*) forest, on marshy streamsides in open *Juniperus*/*Berberis* scrub; 2440–3660(–4570)m. Fl. July–August.

GENERAL DISTRIBUTION. NE India and China.

ETYMOLOGY. From the Greek *leptos* (slender) and *caulon* (stem).

12. P. pachycaulon (Hook. f.) Soó in Ann. Nat. Hist. Mus. Natl. Hung. 26: 364 (1929). Types: India, Sikkim, *Hooker* s.n. (syn. K!); Sikkim, Nattong, *King's collector* 4345 (syn. K!).
Habenaria pachycaulon Hook. f., Fl. Brit. India 6(1): 154 (1890).

Plant 8–16cm tall; *tuber* globose to shortly fusiform. *Stem* short, stout, with sheathing bracts above, 5–10cm long; basal sheaths 2, overlapping, tubular, 1.5–2cm long; stem bracts 2 or 3, leafy, lanceolate, acute, 4–4.5 × 0.8–0.9cm. *Leaf* 1, oblong to oblong-elliptic, subacute to obtuse, sessile, sheathing below, 3–9.5 × 2–3.8cm; sheath 2.5–3cm long. *Inflorescence* subdensely many-flowered; rachis 3.5–4cm long; floral bracts leaf-like, large, lanceolate, acute, 1–1.5 × 0.2–0.3cm. *Flowers* to 8mm across, uniformly green; pedicel and ovary glabrous, 6–8mm long. *Dorsal sepal* thick, linear-oblong, subacute, margins minutely glandular-ciliate, 1-veined, 3–4.5 × 1–2mm; *lateral sepals* similar, spreading, 3.5–4 × 1.2–1.5mm. *Petals* ovate-oblong, fleshy, 3.5 × 1mm. *Lip* simple, fleshy, spurred, ovate-lanceolate, subacute, 3–5 × 1–1.5mm; *spur* incurved, clavate, 4–5mm long. *Column* stout, c.0.3mm tall; anther locules 1–1.5mm long; stigmatic processes short.

Bhutan: N – Upper Mo Chu district (Thangkaphu Chu); **Sikkim** (Dzongri, Nathang, Tsomgo). In grazed turf, in *Betula utilis* forest on N-facing slope; 4100–4240m. Fl. June–July.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Greek *pachy-* (thick) and *caulon* (stem).

NOTES. In the protologue of *Habenaria pachycaulon*, Hooker (1890) described the flowers as purple. This was an error based on an incorrectly applied herbarium label which refers to a specimen (*Hooker* 277) of *Aorchis spathulata*.

Bose & Bhattacharjee (1980) reported *P. pachycaulon* from Sikkim and Jain & Mehrotra (1984) from the E Himalaya, but the latter suggested that it had become extinct. We believe that the species is distinct from, but closely related to, *P. exelliana* for which it has often been mistaken. It can be distinguished by having large, leaf-like bracts above the single leaf, large, more uniformly sized floral bracts and a shorter, more compact inflorescence.

It is possible that *P. exelliana* should be treated at varietal rank under the earlier *P. pachycaulon*.

13. P. sikkimensis (Hook. f.) Kränzlin, Orchid. Gen. Sp. 1: 621 (1898). Type: India, Darjeeling, Sinchal (Senchal), *Thomson* (holo. K not located, probably lost).
Habenaria sikkimensis Hook. f., Fl. Brit. India 6(1): 155 (1890).

Plant sometimes epiphytic, 15–19cm tall; *tuber* globose, 5–6 × 3–4mm; roots thick, spreading. *Stem* short, ebracteate above, 9–13cm long; basal sheaths overlapping, tubular, subacute, 1–1.5cm long. *Leaves* 2 or 3, distant, oblong-elliptic, acute, sheathing at base, sessile, 4–6.5 × 1.9–2cm; sheaths tubular, 2–3cm long. *Inflorescence* laxly 6- to 10-flowered; rachis glabrous, 6–10cm long; floral bracts large, leaf-like, linear-lanceolate, acute to acuminate, 2.2–2.9 × 0.4–0.6cm. *Flowers* 1–1.5cm across, uniformly green; pedicel and ovary strongly curved, 0.9–1.3cm long. *Dorsal sepal* broadly ovate, obtuse, 3-veined, 5.5–8 × 4–5mm; *lateral sepals* oblong-lanceolate, acuminate, revolute, spreading, 3-veined, 0.8–1 × 0.2–0.25cm. *Petals* triangular-lanceolate, falcate, reflexed, 7–8 × 3–3.5mm (at base). *Lip* simple, spurred, linear to linear-lanceolate, caudate-acuminate, 0.9–1 × 0.15–0.2mm (at base); *spur* stout, obtuse, incurved, 1–1.5cm long. *Column* stout, 3mm long; pollinaria 3–4mm long; pollinia 1.5 × 1mm; stigma conjoined, oblong, inserted above mouth of the spur.

Darjeeling (Senchal, Tonglu); **Sikkim** (Lingtoo?, Phedang to Chhokha, Powngong?, Singalila). Epiphytic, on rhododendron in *Abies*/*Rhododendron* forest; 3050–3660m. Fl. July–August.

GENERAL DISTRIBUTION. Nepal, NE India and China.
ETYMOLOGY. From Sikkim where the type species was found (although Senchal is now in Darjeeling district).

14. **P. stenantha** (Hook. f.) Soó in Ann. Hist. Nat. Mus. Natl. Hung. 26: 363 (1925). Types: India, Sikkim, *Hooker* 316 (syn. K-LINDL!, isosyn. K!); Sikkim, *Hooker* s.n. (syn. K!); Sikkim, Jongri (Dzongri), *Clarke* 25836 (syn. K!); Sikkim, Jongri, *Clarke* 25954 (syn. K!); Darjeeling, Tonglo, *Clarke* 27411A (syn. K!); Darjeeling, Tonglu, *Clarke* 27578 (syn. K!).
Habenaria stenantha Hook. f., Fl. Brit. India 6(1): 153 (1890).
Hemihabenaria stenantha (Hook. f.) Finet in Rev. Gén. Bot. 13: 532 (1901).

Plant 30–50cm tall; *tuber* absent; *roots* stoloniferous, thickly fusiform, digitate, 2–4.5 × 0.4–0.7cm. *Stem* erect, stout; basal sheaths tubular, acute, 2–3cm long. *Leaves* 3 or 4 (lower larger than upper), distant along stem, oblong-lanceolate to oblong-oblanceolate, acute to subacute, sessile, base sheathing, 4.5–16 × 0.7–5.5cm; sheaths 3–6cm long; stem bracts leafy, linear-lanceolate, acuminate, 1–2 × 0.2–0.5mm. *Inflorescence* laxly 8- to many-flowered; rachis glabrous, 12–23cm long; floral bracts linear-lanceolate, acute to acuminate, 1-veined, 0.7–1.6 × 0.15–0.3cm. *Flowers* 1–1.5cm across; sepals and petals green to greenish-yellow, lip yellowish; pedicel and ovary glabrous, 1–1.5cm long. *Dorsal sepal* oblong to oblong-ovate, obtuse, erect-concave, 3-veined, 5–6 × 3.5–4mm (at base); *lateral sepals* linear to linear-lanceolate, obtuse, deflexed, 3-veined, 7 × 1.5–2.5mm. *Petals* linear, obtuse, erect, 1-veined, 7–8 × 1–1.5mm. *Lip* simple, linear-lanceolate, apex obtuse, 3-veined, margins entire, 7 × 1–1.5mm; *spur* slender, curved, cylindric, dilated towards apex, 1.6–1.8cm long. *Column* 1.5–1.8mm tall; pollinia broadly ellipsoid-clavate, 0.8–1mm; caudicles long; stigma 1, transverse, inserted above opening of spur. *Fruit* ridged, shortly stalked, 1.5 × 0.4mm.

Bhutan: C – Thimphu district (ridge S of Dochu La); **N** – Upper Kulong Chu district (Lao); **Darjeeling** (Bhotia Basti, Budhwari, Chota Rangit River, Tonglu); **Sikkim** (above Chhokha, Dzongri to Bikbari, Khedum, Lachen, Lachung, Lingtoo, Powngong, Singalila Range, Yak La); **Chumbi** (Tang La). Open *Quercus*/*Rhododendron* forest, in peaty soil beneath *Rhododendron falconeri* and *Pieris* sp.; (910–)2290–3660m. Fl. July–October; Fr. October.

GENERAL DISTRIBUTION. Nepal, NE India and China.
ETYMOLOGY. From the Greek *steno-* (narrow) and *anthos* (flower) in reference to the laterally compressed flower.

Tribe **Diseae** Dressler

Subtribe **Satyriinae** Schltr.

47. **Satyrium** Sw.

Plants terrestrial; *tubers* sessile, undivided. *Leaves* basal, on flowering stem and on separate, sterile shoots. *Inflorescence* terminal, spicate, few- to many-flowered; bracts often reflexed. *Flowers* non-resupinate, often showy; ovary not twisted, 6-ribbed. *Sepals* entire, more or less united to petals and lip at base; *dorsal sepal* linear to oblong; *lateral sepals* obliquely oblong. *Petals* spathulate to lanceolate. *Lip* erect, spurred, more or less hooded, with a broad or narrow mouth and recurved apex; spurs 2, basal, short or long. *Column* erect, incurved; stigma forming upper part of the column, cushion-like or hooded, 3-lobed; anther pendent; pollinia 2; rostellum 3-lobed; viscidia 2, attached by caudicles to pollinia.

The genus *Satyrium* was established in 1800 by Olof Swartz in *Kungliga Svenska Vetenskapsakademiens Avhandlingar*, Stockholm and it has been conserved over the earlier *Satyrium* L. (1753). The genus comprises about 100 species distributed in S Africa, tropical Africa, Madagascar and the Himalayas.

Vogel (1954) reported fly pollination in some African species of *Satyrium* while van der Pijl & Dodson (1966) suggested that the long spurs represented an adaptation for moth pollination.

TYPE. *Satyrium bicorne* (L.) Thunberg; basionym: *Orchis bicornis* L.

ETYMOLOGY. From the Greek *satyrion* (satyr). The Satyri were sylvan demi-gods in Greek mythology known for their lasciviousness. The name has been used since the early herbals of Dioscorides and Pliny, and is probably an allusion to the reputed aphrodisiac properties of the plant's tubers.

Key to species

1. Spurs more than 1cm long; exceeding the ovary .... **1a. S. nepalense** var. **nepalense**
+ Spurs less than 1cm long; shorter than the ovary .... **1b. S. nepalense** var. **ciliatum**

1. S. nepalense D. Don, Prodr. Fl. Nepal: 26 (1825). Type: Nepal, Gossingsthan, *Wallich* s.n. (holo. BM!).

Satyrium perrottetianum A. Richard in Ann. Sci. Nat. (Paris) sér.2, 15: 76 (1841). Type: India, Nilgiri Hills, *Perrottet* (holo. P).

S. albiflorum A. Richard, loc. cit. (1841). Type: India, Nilgiri Hills, *Perrottet* (holo. P).

S. pallidum A. Richard, op. cit.77 (1841). Type: India, Nilgiri Hills, *Perrottet* (holo. P).

S. henryi Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 53 (1919). Type: China, *Henry* 12673 (holo. B†, iso. K!).

S. nepalense f. *albiflora* Tuyama in Hara, Fl. E. Himal.: 450 (1966), **syn. nov.** Type: India, Darjeeling, *Tuyama* (holo. TI).

1a. var. nepalense

Plant 15–70cm tall; *tubers* 1 or 2, ovoid-cylindric. *Stem* stout, bracteate above. *Leaves* 2 or 3, oblong to ovate-lanceolate, sub-basal, fleshy, bases clasping the stem, 4–25 × 1–10cm. *Inflorescence* densely many-flowered; peduncle 10–30cm long, covered with large, leaf-like bracts; rachis 7–14cm long; floral bracts oblong-lanceolate, leaf-like, exceeding ovary, to 2 × 0.6cm. *Flowers* fragrant, 0.8–1.6cm across, pink or white; pedicel and ovary to 5mm long. *Dorsal sepal* oblanceolate-spathulate, obtuse, to 6 × 1.5mm; *lateral sepals* oblong, glandular, to 5.5 × 2.5mm. *Petals* similar to sepals, twisted at mouth of the lip, to 5.5 × 1.2mm. *Lip* conspicuous, orbicular, hooded and keeled on the back, to 0.7 × 1cm; *spurs* 2, long, parallel, extending beyond ovary, 1–1.6cm long. *Column* short, curved, enclosed within lip; anther broad; pollinia clavate.

Bhutan: C – Thimphu (above Motithang, Pajoding, Simtokha to Dochu La), Punakha (Sinchu La, Wangdi Phodrang to Samtengang, Talo), Bumthang (Bumthang, ridge E of Byakar, Kitiphu) and Tashigang (Tashi Yangtsi Forest) districts; **N** – Upper Mo Chu (Laya to Shinche La (F.E.H.2)), Upper Kuru Chu (Denchung to Khoma Chu) and Upper Kuru Chu/Upper Kulong Chu (near Pang La) districts; **Darjeeling** (Tonglu); **Sikkim** (Lachung, Rishi, Singalila Range); **Chumbi** (unlocalised specimen). In open grassland and dryish hill slopes, on rough grassland in forest clearings, in *Pinus/Picea/Quercus* forest; 2100–3720(–4100)m. Fl. August–October.

GENERAL DISTRIBUTION. India (Himalayas), Myanmar and Sri Lanka.

ETYMOLOGY. From Nepal where the type collection was made.

NOTES. The flower colour of var. *nepalense* is variable, both pink and white forms occurring commonly. Although the white forms have sometimes been treated either as a distinct species or as forms we reduce them all to synonymy here. Rao & Sood (1979) provide a detailed discussion of the embryological development of S. *nepalense*.

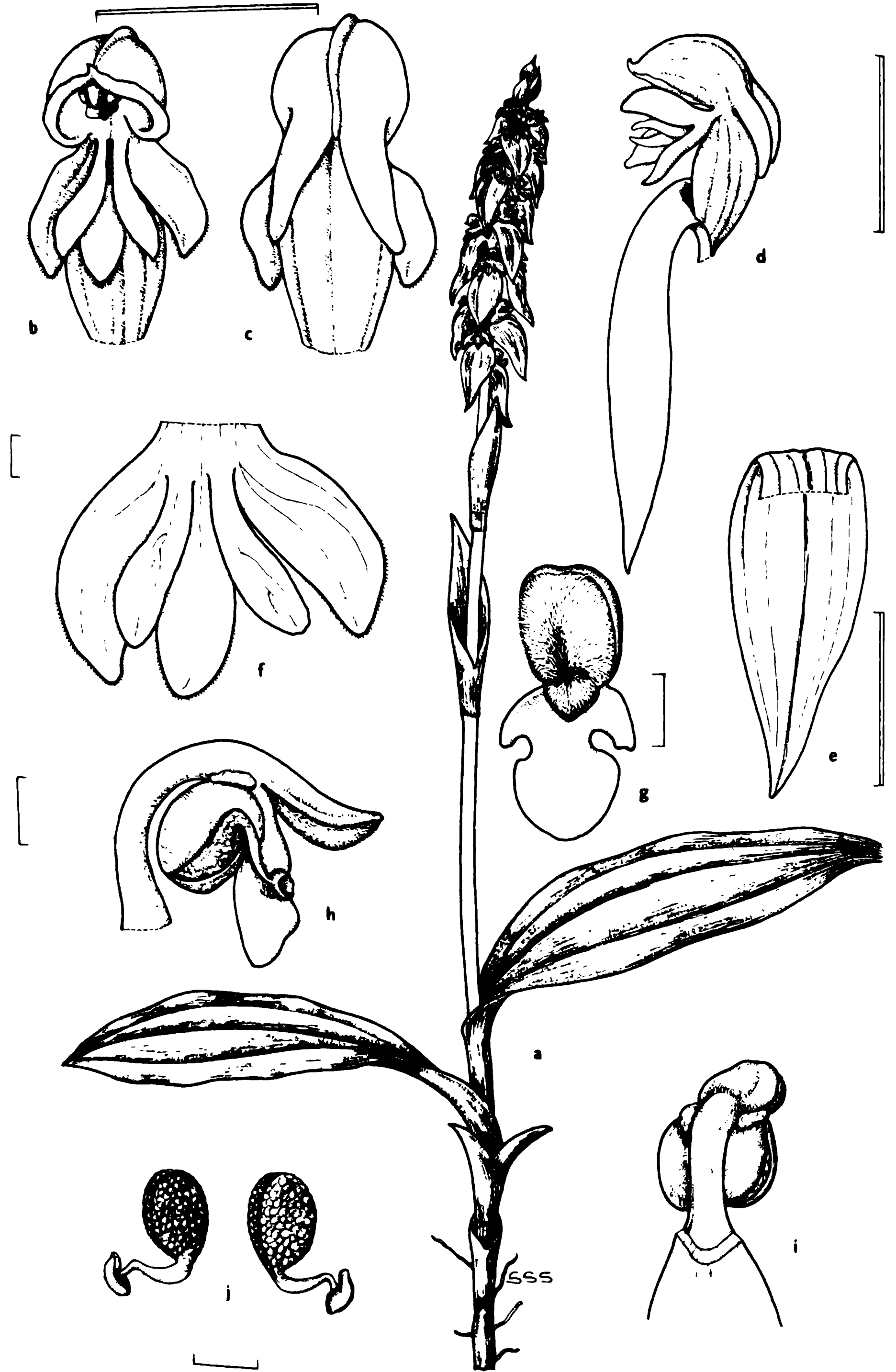


Fig. 48. **Satyrium nepalense** var. **ciliatum**: a, habit; b, flower (front view); c, flower (back view); d, flower with bract (side view); e, floral bract; f, sepals and petals; g, lip with column; h, lip and column (side view); i, column (back view); j, pollinaria. Drawn by Susanna Stuart-Smith from *Gould* 1438 (K).

1b. var. **ciliatum** (Lindl.) Hook. f., Fl. Brit. India 6(1): 168 (1890). Type: Nepal, Gossingsthan, *Wallich's collectors* Wall. Cat. 7025A *p.p.* (holo. K-W!).

Satyrium ciliatum Lindl., Gen. Sp. Orchid. Pl.: 341 (1838).

S. setchuenicum Kränzlin in Bot. Jahrb. Syst. 29: 266 (1900). Type: China, Szechuan (Sichuan), *Rosthorn* 2594 (holo. B†).

S. yunnanense Rolfe in Notes Roy. Bot. Gard. Edinburgh 8(36): 28 (1913). Type: China, Yunnan, *Forrest* 143 (holo. E!).

S. mairei Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 54 (1919). Type: China, Yunnan, *E. Maire* s.n. (holo. B†, iso. P).

S. tenii Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 17: 63 (1921). Type: China, Yunnan, *S. Tén* s.n. (holo. B).

S. pycnostachyum Schltr., *loc. cit.* (1921). Type: China, Yunnan, *S. Tén* s.n. (holo. B).

S. microcephalum Kränzlin, *op. cit.* 109 (1921). Type: China, Yunnan, *S. Tén* 1397 (holo. B).

S. aceras Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 12: 339 (1922). Type: China, Szechuan (Sichuan), *Limpricht* 2363 (holo. B†).

S. tschangii Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 19: 374 (1924). Type: China, Yunpe, *Tschang* 42 (holo. B).

S. nepalense subsp. *yunnanense* (Rolfe) Soó in Ann. Hist.-Nat. Mus. Natl. Hung. 26: 380 (1929).

Similar to var. *nepalense* but differs as follows: plant usually smaller, to 30cm tall. *Leaves* lanceolate-oblong, to 15 × 3cm. *Floral bracts* reflexed, acute to acuminate, to 2cm long. *Petals* erose, ciliate. *Lip* with spurs shorter than the ovary, less than 1cm long. **Fig. 48**; **Plate 6**.

Bhutan: **C** – Ha (Damthang to Sharithang, Tare La), Thimphu (Dochu La, Motithang, Pajoding, Paro), Tongsa (unlocalised *Griffith* specimen), Bumthang (Lami Gompa), Mongar (Kuru Chu, N of Lhuntse) and Sakden (Mera) districts; **N** – Upper Mo Chu (Gasa Dzong) and Upper Kulong Chu (Me La Valley) districts; **Darjeeling** (Senchal); **Sikkim** (Chomnagu, Dzongri, Nathang, Phalut, Thanggu, Yak La); **Chumbi** (Lingmatang to Gautsa). On shady, mossy rocks, damp grassy bank in scrub, on peaty soil in colonies, on roadside bank in partly cleared *Tsuga* forest, on open grassy banks in *Abies* forest; 1800–4350m. Fl. July–September.

GENERAL DISTRIBUTION. Himalayas and China (SE Xizang).

ETYMOLOGY. From the Latin *ciliatus* (having fine hairs) in reference to the petal margins.

NOTES. Lindley (1838), in his protologue of *S. ciliatum*, commented that this species was mixed with *S. nepalense* on the type sheet. Indeed they are frequently found growing together and since the main distinguishing feature is the spur length, we treat them as varieties rather than distinct species.

Chen (1979) revised *S. ciliatum* and its allies in China. He found that plants could exist in staminate, pistillate or bisexual forms: the *S. ciliatum* group were bisexual, the *S. setchuenicum* group were pistillate and the *S. yunnanense* group were staminate, though he included them all under the synonymy of *S. ciliatum*. We follow this treatment here but feel that the yellow-flowered *S. yunnanense* group may merit some form of taxonomic recognition.

Subfamily **EPIDENDROIDEAE** Lindl.

CYMBIDIOID PHYLAD

Tribe **Malaxideae** Lindl.

48. **Liparis** L.C. Richard

Plants small, terrestrial, lithophytic or epiphytic; arising from pseudobulbs or corms. *Leaves* 1 to several, plicate, sheathing at base. *Inflorescence* terminal, erect, racemose, laxly few- to many-flowered. *Flowers* small. *Sepals* free, spreading. *Petals* filiform to linear. *Lip* usually recurved, entire to 3-lobed, acute, obtuse or emarginate, sometimes callose. *Column* usually elongate, incurved, narrowly winged above; pollinia 4, ovoid, waxy.

48. LIPARIS

The genus *Liparis* was described in 1818 by L.C. Richard in the *Mémoires du Muséum d'Histoire Naturelle, Paris*. The genus comprises about 250 species widespread in the tropics of the world and less common, but still widespread, in the temperate regions.

Ridley (1886) monographed the genus and divided it into two sections: *Mollifoliae* (with three subsections) and *Coriifoliae* (with four subsections). Seidenfaden (1976a) revised the Thai species and based his treatment on that of Hooker (1890). He adopted three sections: *Liparis* (plants terrestrial, leaves non-jointed, usually thin and membranous, equivalent to Ridley's *Mollifoliae*); *Coriifoliae* (plants epiphytic, leaves jointed, often coriaceous, inflorescence lax, lacking overlapping bracts); *Distichae* (leaves jointed, inflorescence with close, distichous, overlapping bracts). Rasmussen (1979) reviewed Thouars' works on orchids and discussed his treatment of *Liparis* and its sections. Garay & Romero-Gonzalez (1999) provided a revised sectional treatment which we follow here.

Little is known about the pollination of *Liparis* but Dressler (1993) has reported fly and hemipteran pollination. Several species may be autogamous. Füller (1966) and Reinhard *et al.* (1991) suggested that *L. loeselii*, a European species, is regularly self-fertilised. Percival (1965) cited *L. caespitosa* as being cleistogamous (self-fertilising) in the misty rainforest, but chasmogamous (out-crossing) in the drier air outside the forest.

TYPE. *Liparis loeselii* (L.) L.C. Richard; basionym: *Ophrys loeselii* L.
ETYMOLOGY. From the Greek *liparos* (oily, greasy), referring to the smooth, glossy sheen of the leaves of many species.

Key to species

1. Plants with non-jointed, usually membranous, leaves; usually terrestrial 2
+ Plants with jointed, often coriaceous, leaves; usually epiphytic 12

2. Plants with 1 leaf 3
+ Plants with 2 or more leaves 5

3. Leaf cordate, more than 7.5cm wide .... **2. L. cordifolia**
+ Leaf not cordate, less than 4cm wide 4

4. Floral bracts less than 5mm long; flowers less than 5mm long .... **4. L. gamblei**
+ Floral bracts more than 7mm long; flowers more than 6mm long .... **5. L. glossula**

5. Plant less than 7cm tall; 2- or 3-flowered .... **9. L. pygmaea**
+ Plant more than 12cm tall; more than 5-flowered 6

6. Lip broadly lanceolate, apex triangular, acute .... **8. L. petiolata**
+ Lip not as above, apex obtuse-rounded, 2-lobed or fimbriate 7

7. Petals spathulate, with 3 or more veins; leaves narrowly elliptic-lanceolate, less than 2cm wide, alternate .... **7. L. odorata**
+ Petals linear, 1-veined; leaves broadly elliptic-ovate, more than 3cm wide 8

8. Lip ecallose .... **10. L. tigerhillensis**
+ Lip with a distinct callus 9

9. Plant 3- to 6-leaved .... **6a. L. nervosa var. nervosa**
+ Plant with 2 (occasionally 3) leaves 10

10. Petals not reflexed or twisted, more than 0.5mm wide; leaves 2 or 3 **6b. L. nervosa var. khasiana**
+ Petals reflexed or twisted, less than 0.4mm wide; leaves always 2 11

11. Floral bracts less than 2mm long; leaf apex subacute .... **1. L. cathcartii**
+ Floral bracts more than 4mm long; leaf apex acuminate .... **3. L. deflexa**

12. Pseudobulb with 1 leaf 13
+ Pseudobulb with 2 or more leaves 15

13. Sepals with 3 or more veins .... **12. L. bootanensis**
+ Sepals with 1 vein 14

14. Lip lacking distinct lateral lobes .... **13. L. cespitosa**
+ Lip with distinct falcate, forward pointing lateral lobes .... **17. L. mannii**

15. Leaves linear-oblong, less than 1cm wide; plants often very small 16
+ Leaves oblong to elliptic, more than 1cm wide; plants medium to large in size 20

16. Leaves more than 6cm long; plant more than 12cm tall .... **21. L. resupinata**
+ Leaves less than 6cm long; plant less than 12cm tall 17

17. Column lacking distinct side keels; leaves linear .... **18. L. perpusilla**
+ Column with distinct side keels; leaves oblong 18

18. Hypochile of lip with a high, U-shaped callus at base .... **14. L. delicatula**
+ Hypochile of lip lacking a high, U-shaped callus at base 19

19. Floral bracts cordate, clasping, more than 5mm long; lip cordate; leaves ovate-oblong **16. L. lydiae**
+ Floral bracts linear, sessile, less than 2mm long; lip quadrate; leaves linear-lanceolate **20. L. platyrachis**

20. Sepals with 3–5 veins 21
+ Sepals with 1 vein 23

21. Lip orbicular .... **19. L. plantaginea**
+ Lip truncate to emarginate 22

22. Lip longer than broad; inflorescence longer than leaves; flowering July to August **11. L. bistriata**
+ Lip broader than long; inflorescence shorter than leaves; flowering October to December **23. L. stricklandiana**

23. Pseudobulbs short to long and stem-like, more than 10cm tall; lip lacking ear-like margins **24. L. viridiflora**
+ Pseudobulbs short, less than 4.5cm tall; lip with ear-like folds at margins 24

24. Pseudobulbs less than 2.5cm tall; lip not strongly deflexed centrally .... **15. L. elliptica**
+ Pseudobulbs more than 3.2cm tall; lip strongly deflexed centrally .... **22. L. somai**

Section **Liparis**

[*Mollifoliae* Rchb. f.; Ridley in J. Linn. Soc., Bot. 22: 253 (1886)]

1. **L. cathcartii** Hook. f., Icon. Pl. ser.3(19): t.1808 (1889); Fl. Brit. India 5(2): 694 (1890). Types: India, Sikkim, *Hooker* 103 (syn. K-LINDL!, isosyn. K!); Darjeeling, Sandakphu, *Clarke* 35033 (syn. K!, isosyn. BM! W!); Darjeeling, Tonglu, *Clarke* 35037 (syn. K!).

Liparis rupestris sensu Ridley in J. Linn. Soc., Bot. 22: 268 (1886), non Griff.

Plant terrestrial, 14–25cm tall. *Pseudobulbs* narrowly ovoid, 1.5–2 × 0.7–1cm. *Leaves* 2, from apex of pseudobulb, subopposite, broadly ovate to elliptic-ovate, subacute, contracted at base into sheathing petiole; blade 5–9 × 2–5.5cm; petiole 3.5–6cm long. *Inflorescence* laxly 5- to 7-flowered; peduncle arising from base of pseudobulb, decumbent below, erect above; bracts several subacute; rachis 3.5–5.5cm long; floral bracts minute, broad, erect, less than 0.5mm long. *Flowers* 1–1.5cm long; sepals and petals green, lip purple with a yellow anterior edge, column purple at base, green at top; pedicel and ovary straight, linear, 6–8mm long. *Sepals* similar, oblong, obtuse, spreading, edges recurved, 6–8 × 1.5–2mm; *lateral sepals* appressed to lower surface of lip. *Petals* linear, curved and reflexed, 10–12 × 0.2–0.4mm long. *Lip* flat, obovate; base clawed, cordate, with 2 obscure calluses, 0.8–1 × 0.7–0.9cm; apex truncate, erose, cuspidate in middle. *Column* slender, curved, with 2 short, broad wings, 3–4mm long. *Fruit* erect, c.2 × 0.7cm. **Plate 6.**

Bhutan: C – Punakha (Wangdi Phodrang (field record)) and Mongar/Tashigang (Donga La) districts; **N** – Upper Kuru Chu district (Denchung); **Darjeeling** (Sandakphu, Tonglu); **Sikkim** (Lachen Valley, Lachung Valley, Singalila Range); **Chumbi** (unlocalised King's *collector* specimen). On slopes in damp bamboo forest, on mossy banks in dense rain-forest; 2100–3000m. Fl. April–July.

GENERAL DISTRIBUTION. NE India and China.

ETYMOLOGY. Named after the Scottish Civil Servant and plant collector John Ferguson Cathcart (1802–1851), who collected plants in Darjeeling.

2. **L. cordifolia** Hook. f., Icon. Pl. ser.3(19): t.1811 (1889). Types: India, Sikkim, Yoksam, *Clarke* 25184 (syn. K!); India, Khasia *Griffith* 35 (syn. K-LINDL!); India, Khasia, *Hooker* & Thomson 8 (syn. K!, isosyn. LE!).

Liparis keitaoensis Hayata, Icon. Pl. Formos. 7: 40, t.13 (1918). Type from Taiwan.

L. sekiteiensis Kudo ex Masamune in J. Geobot. 18(1): t.158 (1970), nom. nud.

Plant terrestrial, up to 18cm tall. *Pseudobulbs* crowded, compressed, ovoid, acute, 3–4cm long. *Stem* c.3mm wide, with small, triangular bracts at intervals. *Leaf* 1, ovate to cordate, acuminate, sheathing at base, distinctly veined, deep green, 5–12 × 3.5–10cm. *Inflorescence* subdensely 6- to 20-flowered; rachis 2.5–5cm long; floral bracts triangular, acute, less than 0.5mm long. *Flowers* up to 1.5cm long, uniformly apple-green; pedicel and ovary linear, 0.8–1.2cm long. *Sepals* similar, linear-lanceolate, acute, 3-veined, 6–7 × 1–1.5mm. *Petals* linear, spreading, 10–12 × 0.2–0.3mm. *Lip* obovate-deltoid, triangular, flat with concavity at base, 8–9 × 6–7mm; apex truncate; margin crenulate. *Column* knob-like, curved, 4–6mm long, expanded at base, apex with 2 short, rounded wings.

Bhutan: N – Upper Kulong Chu district (between Tobrang and Laurijampa (M.F.B.)); **Sikkim** (Rimbi Chu, Yoksam). 1660–2000m. Fl. (March–)October–November.

GENERAL DISTRIBUTION. India (NW Himalaya to Assam) and China.

ETYMOLOGY. From the Latin *cordis* (heart) and *-folius* (leaved).

3. **L. deflexa** Hook. f., Fl. Brit. India 5(2): 697 (1890); Icon. Pl. ser.4(21): t.2008 (1892). Type: India, Darjeeling, *Griffith's collectors* 5367 (holo. K!).

Liparis prazeri King & Pantling in J. Asiat. Soc. Bengal 66(3): 582 (1897). Type: Myanmar (Burma), Huk s.n. (holo. K!).

Plant terrestrial, up to 30cm tall. *Pseudobulbs* cylindric, covered in membranous sheaths, 0.8–1 × 0.5–0.7cm. *Leaves* 2, basal, subopposite, sheathing at base, plicate, elliptic-lanceolate, acuminate, 7-veined, 7–10 × 3–5cm. *Inflorescence* laxly up to 20-flowered; peduncle slender, bracteate, 8–13cm long; peduncle bract 1, linear-lanceolate, acute, 6–9mm long; rachis 7–13cm long; floral bracts deflexed, lanceolate, acuminate, 0.5–1.5cm long. *Flowers* up to 5mm long, uniformly yellow; pedicel and ovary 6–9mm long. *Sepals* subsimilar, narrowly oblong, 4–6 × 1–2mm; dorsal sepal acute; lateral sepals obtuse *Petals* linear-oblong, obtuse, reflexed with recurved margins, 4–6 × 0.3–0.4mm. *Lip* flat, orbicular-reniform to flabellate, contracted at junction with the column, margins at base entire, 4–8 × 5–6mm; apex broad, margins crenulate, emarginate, mucronate; calluses 2, obscure, under the column. *Column* curved, 2–3mm long, with narrow rounded wings near apex. *Fruit* cylindric, 1–1.5 × 0.3–0.5cm.

Darjeeling (1km S of Kalimpong); **Sikkim** (unlocalised *Pantling* specimen). In tropical valleys, in grassland; 1150m. Fl. July.

GENERAL DISTRIBUTION. India, Nepal and Myanmar.
ETYMOLOGY. From the Latin *deflexus* (bent abruptly downwards) in reference to the floral bracts.

4. **L. gamblei** Hook. f., Icon. Pl. ser.3(19): t.1812 (1889). Types: India, Sikkim, Rimbi Chu (Rungbee), *Clarke* 12450 (syn. K!); Darjeeling, Senchal, *Gamble* 3988A (syn. K!).

Plant terrestrial, up to 16cm tall. *Pseudobulbs* ovoid, 0.8–1.4 × 1–1.4cm. *Leaf* 1, oblong-elliptic, acute to acuminate, sheathing at base, margins crenulate, 8–9 × 4–4.5cm; sheath 3–4cm long. *Inflorescence* subdensely many-flowered; peduncle ridged, ebracteate, enfolded in the leaf base, 3.5–8cm long; rachis 5–8cm long; floral bracts lanceolate, acute, 3–5 × 1–2mm. *Flowers* 4–7mm long; sepals dark green, lip with a broad margin of brownish-purple and veins the same colour; pedicel and ovary linear, 7–8mm long. *Sepals* similar, ovate-lanceolate, acute, 1-veined, 5–8 × 1.8–2mm. *Petals* linear, spreading, 1-veined, 4–10 × 0.2–0.3mm. *Lip* simple, elliptic-obovate, apex acute, margin wavy-crenate, 2-callose at base, 4.5–7 × 2–4mm. *Column* strongly curved, 2.5–3.5mm long.

Darjeeling (Rungirun, Senchal, Takdah); **Sikkim** (Rimbi Chu). 1800m. Fl. June–July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after James Sykes Gamble (1847–1925) a British forester and botanist who worked in India and collected extensively around Darjeeling.

5. **L. glossula** Rchb. f. in Linnaea 41: 43 (1876). Type: India, unlocalised, *B. Rözl* (holo. W! Herb. no. 39795).

Plant terrestrial, 10–28cm tall. *Pseudobulbs* tufted, oblong to ovoid, 3.5–5cm long. *Leaf* 1, oblong to linear-oblong, obtuse to subacute, sheathing at base, 3.5–14 × 1.5–4cm. *Inflorescence* laxly 7- to 10-flowered; peduncle ridged, ebracteate, sheathed at base, 5–14cm long; peduncle sheath, lanceolate, subacute, 4–6cm long; rachis glabrous, 5–8cm long; floral bracts linear, acute, 1-veined, 0.6–1 × 0.1–0.15cm. *Flowers* 1–1.5cm long; sepals and petals green, lip purple; pedicel and ovary glabrous, 0.8–1cm long. *Sepals* similar, oblong-lanceolate, acute, 1-veined, 0.7–1 × 1–1.8cm. *Petals* linear, reflexed, 1–1.2 × 0.05–0.1cm. *Lip* simple, oblong, broadly rounded, margin ciliate to crenulate, 7–8 × 6–7mm. *Column* 2–3mm long, with 2 short wings at apex.

Sikkim (Thalet?); **Chumbi** (Peemong, Yatung). 3000m. Fl. July.

GENERAL DISTRIBUTION. NW Himalaya, Nepal and NE India.
ETYMOLOGY. From the Greek *glossa* (tongue) possibly in reference to the lip shape.

6. **L. nervosa** (Thunberg) Lindl., Gen. Sp. Orchid. Pl.: 26 (1830). Type: Japan, *Thunberg* s.n. (holo. UPS-THUNB! Herb. no. 21373).
Ophrys nervosa Thunberg, Fl. Jap.: 27 (1784).

Epidendrum nervosum (Thunberg) Thunberg in Mus. Nat. Acad. Upsal. 9: 138 (1791).
Cymbidium nervosum (Thunberg) Sw. in Nova Acta Regiae Soc. Sci. Upsal. 6: 76 (1799).
Malaxis nervosa (Thunberg) Sw. in Kongl. Vetensk. Acad. Nya. Handl. 21: 235 (1800).
Cymbidium bituberculatum Hook., Exot. Fl. 2: t.116 (1824). Type: Nepal, cult. Cooper (holo. K, not found).
Liparis bituberculata (Hook.) Lindl. in Bot. Reg. 11: sub t.882 (1825).
Sturmia nervosa (Thunberg) Rchb. f. in Bonplandia 3: 250 (1855).
L. macrocarpa Hook. f., Fl. Brit. India 5(2): 696 (1890), **syn. nov.** Types: India, Sikkim and Khasia Hills, Hooker 165 (syn. K!).
Leptorchis bituberculata (Hook.) Kuntze, Revis. Gen. Pl. 2: 671 (1891).
Liparis nervosa f. *aureovariegata* Nakajima in J. Geobot. 17: 55 (1969) Type from Japan.
L. nervosa var. *formosana* (Rchb. f.) Hiroe, Orchid Flowers 2: 77 (1971).
L. shaoshunia S.S. Ying, Col. Illustr. Indig. Orch. Taiwan 1: 230 (1977). Type from Taiwan.

6a. var. **nervosa**

Plant terrestrial, lithophytic or epiphytic, 18–70cm tall. *Pseudobulbs* conical, enveloped in leaf sheaths, 3–4cm long. *Stem* erect, longer than the leaves, glabrous. *Leaves* (2–)3–6, thin, plicate, ovate, ovate-elliptic to ovate-lanceolate, acute to subacuminate, sheathing the stem below, 7.5–15.5 × 2.5–7cm. *Inflorescence* laxly many-flowered; peduncle ebracteate, 10–15cm long; rachis 6–24cm long; floral bracts erect, spreading or reflexed, ovate, acute, 3–5 × 2–3mm. *Flowers* delicate, opening in succession; sepals uniformly pale yellow to yellowish-purple to green, petals yellowish-green to purple, lip yellowish-green with purple markings, column white to greenish-white; pedicel and ovary cylindric, 0.9–1.5cm long. *Sepals* subsimilar, reflexed; *dorsal sepal* oblong to elliptic-oblong, acute to obtuse, margins revolute, 3-veined, 8–9 × 1.5–3mm; *lateral sepals* falcate-ovate, acute to obtuse, margins revolute, 3-veined, 7–8 × 2.2–5mm. *Petals* reflexed, linear-oblanceolate to linear-spathulate, 1-veined, 6–7 × 1–3mm. *Lip* simple, wedge-shaped, flabellate, 2-lobed in front, strongly recurved, with 2 triangular obtuse calluses at base, 6–8 × 3–4mm. *Column* fleshy, curved, thin-margined, 3–6mm long, winged in front. *Fruit* erect, short-stalked, ovoid, ridged, 1–2.5 × 0.4–1cm. **Plate** 7.

Darjeeling (unlocalised Griffith collection); **Sikkim** (Chunthang, Lachen Valley). In hot valleys; 900–2100m. Fl. May–August; Fr. December.

GENERAL DISTRIBUTION. Widespread in the Old and New World tropics (see note below).
ETYMOLOGY. From the Latin *nervosus* (veined) in reference to the leaves.
NOTES. *L. nervosa* is a widespread and variable species. Garay & Sweet (1974) discussed the taxonomic problems of this species and provided a complete synonymy. The Himalayan plants have usually been referred to *L. bituberculata*. Hooker (1890) described a further plant from Sikkim and Khasia as *L. macrocarpa* which he stated resembled 'a large state of *L. bituberculata* but is I have no doubt a very distinct species'. We have examined the type specimens at K, which consist of fruiting material only, and believe it to be conspecific with *L. nervosa*.

6b. var. **khasiana** (Hook. f.) P.K. Sarkar in J. Econ. Taxon. Bot. 5(5): 1008 (1984). Types: India, Khasia, Myrung, Griffith 5068 (syn. K!); Pawang, Hooker & Thomson s.n. (syn. K!); Moflong, Hooker & Thomson s.n. (syn. K!).
Liparis bituberculata var. *khasiana* Hook. f., Fl. Brit. India 5(2): 696 (1890).
L. khasiana (Hook. f.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 76 (1951).
L. breviscapa A.P. Das & Dorjay in J. Econ. Taxon. Bot. 16: 226 (1992), **syn. nov.** Type: India, Darjeeling, Birch Hill, A.P. Das 603 (holo. CAL).

Plant terrestrial, 11–30cm tall; *roots* long and slender. *Pseudobulbs* small, ovoid, sheathed, narrowed above, 1.5–3 × 0.5–0.7(–1.3)cm; sheaths 2 or 3, overlapping, 2–3cm long. *Leaves* 2 or 3, broadly ovate to orbicular-ovate, subsessile to shortly petiolate and sheathing at base, 4.5–8(–9) × (1.5–)3–5.6cm;

petiole 0.5–2cm long: sheath 1–1.5cm long. *Inflorescence* 9- to 12-flowered; peduncle glabrous, ebracteate or with a single, small bract, (7.5–)9–13cm long; rachis glabrous, 3–4.5cm long; floral bracts small, ovate-lanceolate to linear-lanceolate, 1–1.5 × 0.45–0.55mm. *Flowers* 7–9mm across, uniformly purple, lip purple-brown; pedicel and ovary long, slender, glabrous, 0.6–1.1cm long. *Dorsal sepal* oblong-lanceolate, subacute, 3–4.5 × 1–1.5mm; *lateral sepals* oblong, obtuse, 4–5 × 1.5–2mm. *Petals* linear-oblong, obtuse, 4.5–5.5 × 0.5–0.8mm. *Lip* simple, wedge-shaped, obcordate, broader at apex or 2-lobed, margins weakly undulate, 4–5 × 2–3mm. *Column* curved, 2.5–3mm long. *Fruit* erect, stalked, 1.2–1.5 × 0.4–0.6cm; stalk 7–8mm long.

Bhutan: C – Punakha district (Samtengang); **Darjeeling** (Birch Hill (Das & Dorjay, 1992)). In open places among grass; 1400–2000m. Fl. July–September.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From Khasia (now in the Indian state of Meghalaya), where the type material was collected.

NOTES. Das & Dorjay (1992) stated that *L. breviscapa* was closely related to *L. nervosa* but differed as follows: plant smaller; leaf veins brown rather than green; inflorescence shorter; peduncle always shorter than the larger leaf; lip broader and brown (rather than brownish-green). From this description we believe that this species is indistinguishable from *L. nervosa* var. *khasiana* and therefore reduce it to synonymy here.

7. **L. odorata** (Willdenow) Lindl., Gen. Sp. Orchid. Pl.: 26 (1830). Type: based on 'katou-ponnam-maravara' in Rheede, Hort. Malab. 12: 55, t.28 (1693)!

Malaxis odorata Willdenow, Sp. Pl. ed.4(1): 91 (1805).

M. lancifolia J.E. Smith in Rees, Cycl. 22: 7 (1812). Type: Nepal, Suembu, *Buchanan-Hamilton* s.n. (holo. LINN! Herb. no. 1396.5).

Empusa paradoxa Lindl. in Bot. Reg. 10: sub t.825 (1824). Type: Nepal, coll. *Wallich* Wall. Cat. 1937.1 (holo. herb. BM!, iso. K-W! K!).

Liparis paradoxa (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 218 (1861).

L. paradoxa var. *parishii* Hook. f., Fl. Brit. India 5(2): 698 (1890). Types: Myanmar (Burma), *Parish* (syn. K); *Lobb* (syn. K).

L. parishii (Hook. f.) Hook. f., op. cit. 6(1): 182 (1890).

Leptorchis odorata (Willdenow) Kuntze, Revis. Gen. Pl. 2: 671 (1891).

Liparis guamensis Ames in Philipp. J. Sci. 9: 11 (1914). Type from Guam.

L. tenii Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 17: 66 (1921). Type: China, Yunnan, S. *Tén* s.n. (holo. B).

L. teniana Kränzlin, op. cit. 112 (1921). Type: China, Yunnan, S. *Tén* 1219 (holo. Cl).

L. simeonis Schltr., op. cit. 20: 383 (1924). Type: China, Yunnan, S. *Tén* 180 (holo. B).

L. odorata var. *longiscapa* Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 370 (1925). Type from Thailand.

L. odorata var. *intacta* Kerr, op. cit. 1927: 216 (1927). Type from Thailand.

L. tonkinensis Gagnepain in Bull. Soc. Bot. France 79: 167 (1932). Type from Vietnam.

L. longiscapa (Rolfe) Gagnepain and Guillaumin in Lecompte, Fl. Indo.-Chine. 6: 182 (1932).

Plant terrestrial, 15–30cm tall. *Pseudobulbs* narrowly ovoid-conical, sheathed, 1–1.5 × 0.8–1cm. *Leaves* 2 or 3, alternate, narrowly ovate-lanceolate to elliptic-lanceolate, acute, narrowed to clasping sheath, plicate, strongly 5-veined, 6–10 × 1.4–2.2cm. *Inflorescence* 4- to 15-flowered; peduncle thick, striate, 1- or 2-bracteolate, 10–14cm tall; rachis 6–11cm long; floral bracts ovate-lanceolate, acute to apiculate, 4–6mm long. *Flowers* erect, up to 5mm long, green, lip dull purple; pedicel and ovary twisted, glabrous, 0.7–1.1cm long. *Dorsal sepal* linear, obtuse, spreading, margins recurved, 6–7mm long; *lateral sepals* broadly ovate, 5-veined, recurved, 4–6mm long. *Petals* linear, obtuse, reflexed, margins recurved, 6–8mm long. Lip quadrate, deflexed at the middle, edges entire, 3–4mm long; apex broad, emarginate, erose, with a short apiculus; calluses 2, erect tooth-like. Column straight to curved, c.5mm long, with 2 large, crenulate wings at apex.

Bhutan: S – Chukka district (S of Chima Kothi); C – Punakha district (Lobesa); **Sikkim** (Chunthang, Lema, Temi, Tista Valley). In tropical valleys and wet bank by roadside with scattered scrub; 900–2010m. Fl. May–September.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China, Thailand, Laos, Vietnam, Japan, Taiwan and Guam.

ETYMOLOGY. From the Latin *odoratus* (fragrant).

NOTES. Garay & Sweet (1974) included L. *odorata* within the synonymy of L. *nervosa*. Seidenfaden (1976a) discussed the taxonomic problems of this species and treated it as distinct from L. *nervosa* but used the name L. *paradoxa* (based on *Empusa paradoxa* Lindl.) though he mentioned that the earlier name of L. *odorata* had been preferred by some authors. In fact L. *odorata* (based on *Malaxis odorata* Willdenow) is the earlier name as it is based solely on the Rheede drawing cited above. Nicolson, Suresh & Manilal (1988) in their discussion of Rheede's names followed Garay & Sweet. We have examined Rheede's illustration, consider L. *paradoxa* to be conspecific, and that the earlier name should be retained for this species. We agree with Seidenfaden that L. *odorata* should be treated as a separate species from L. *nervosa*, differing in having narrowly elliptic-lanceolate leaves and spathulate petals with 3 or more veins.

There have been conflicting reports of chromosome numbers for the two species: Miduno (1940) reported n = 21 for L. *nervosa*, Mehra & Vij (1970) reported n = 18 for L. *paradoxa* but Sehgal & Sehgal (1989) reported n = 21 for L. *paradoxa*.

8. **L. petiolata** (D. Don) P.F. Hunt & Summerhayes in Kew Bull. 20: 52 (1966). Type: Nepal, *Wallich* 1945 (holo. BM!).

Acianthus petiolatus D. Don, Prodr. Fl. Nepal: 29 (1825).

Malaxis cordifolia J.E. Smith in Rees, Cycl.: 22 (1812). Type: Nepal, Narainhetty, *Buchanan-Hamilton* s.n. (holo. LINN! Herb. no. 1396.15).

Liparis nepalensis Lindl. in Bot. Reg. 11: sub t.882 (1825). Type: Nepal, coll. *Wallich* Wall. Cat. 1945 (holo. K-LINDL!, iso. K-W!).

L. *rupestris* var. *purpurascens* Ridley in J. Linn. Soc., Bot. 22: 268 (1886). Type: India, Sikkim, *Hooker* 106 (holo. K-LINDL!).

L. *pulchella* Hook. f., Icon. Pl. ser.3(19): t.1810 (1889). Types: India, Khasia, *Hooker & Thomson* 104 (syn. K-LINDL!, isosyn. K!); Naga Hills, *Prain* 58 (syn. K!).

L. *angkae* Kerr in Bull. Misc. Inform. Kew 1927: 215 (1927). Type from Thailand.

Plant terrestrial, 15–20cm tall. *Pseudobulbs* narrowly ovoid, compressed, striate, c.3 × 3cm. *Stem* sheathed at base. *Leaves* 2, broadly ovate to suborbicular, acute to acuminate, base rounded to cordate, petiolate, 7–11 × 3–8.5cm; petiole sheath-like, 6.5–9cm long. *Inflorescence* few-flowered; rachis 3–6cm long; floral bracts linear-lanceolate, 0.8–1.4cm long. *Flowers* up to 1cm long; petals and lip purple, sepals green; pedicel and ovary 3–4mm long. *Sepals* subsimilar, lanceolate, acuminate, edges revolute; dorsal sepal reflexed, 5–7mm long; lateral sepals parallel to the lip. *Petals* linear, spreading, 6–7mm long. *Lip* flat, elliptic, slightly cordate at base and narrowed towards apex, 0.7–1.2 × 0.4–0.5cm; central ridge stout, smooth, ending in a mucronate point, many-veined; edges entire; base with 2 calluses. *Column* curved, 2–3mm long, base thickened, wings stout.

Bhutan: C – Mongar/Tashigang district (Donga La); **Darjeeling** (Ghoom (F.E.H.2), unlocalised Cowan and Griffith specimens); **Sikkim** (Damthang to Tendong). In dense jungle and hot valleys; 1800–2830m. Fl. May–July.

GENERAL DISTRIBUTION. Nepal, NE India and Thailand.

ETYMOLOGY. From the Latin *petiolatus* (having a petiole).

9. L. **pygmaea** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 34, t.44 (1898). Type: India, Sikkim, Jongri (Dzongri), *Pantling* 449A (holo. CAL, iso. E! K! LE! W!).

Liparis nana Rolfe in Bull. Misc. Inform. Kew 1913: 28 (1913). Type: Vietnam, Annam, *sine coll.* (holo. K, not found).

Plant terrestrial or lithophytic, 4–7cm tall. *Pseudobulbs* narrowly ovoid, loosely enveloped in 2 or 3 membranous sheaths, 0.8–1 × 0.4–0.5cm. *Leaves* 2, from apex of pseudobulb, subopposite, ovate, acute, sessile, sheathing at base, 1–1.5 × 0.3–0.5cm. *Inflorescence* 2- or 3-flowered; peduncle ebracteate, 2–2.5cm long; rachis 2–2.5cm long; floral bracts linear, membranous, 1.5–2mm long. *Flowers* 6–8mm long, uniformly yellowish; pedicel and ovary erect, linear, 3–4mm long. *Dorsal sepal* oblong, obtuse, arching over the column, 0.8–1.1 × 0.2cm; *lateral sepals* linear, lying parallel to lip, 6–7mm long. *Petals* linear, acute, spreading, margins reflexed, 5–7mm long. *Lip* oblong-ovate, slightly deflexed from the middle, c.5 × 2mm; hypochile concave, edges entire, with a large, 2-lobed callus just under the column; epichile broad, apiculate, obscurely erose. *Column* c.2mm long, shortly winged at apex, base wide; pollinia elliptic; rostella 2.

Sikkim (Chokchurang Chhu, Dzongri, Jamlinghang, Tsomgo). On moss-covered rock under *Rhododendron*, growing in moss on rocks; 3810–3900m. Fl. June–July.

GENERAL DISTRIBUTION. E Himalaya and Vietnam.

ETYMOLOGY. From the Latin *pygmaeus* (pygmy, dwarf), referring to the habit.

NOTE. We agree with Seidenfaden (1976a) who considered this to be conspecific with *L. nana* Rolfe.

10. L. **tigerhillensis** A.P. Das & Chandra in J. Econ. Taxon. Bot. 12(2): 403 (1988). Type: India, Darjeeling, Tiger Hill, *A.P. Das* 1051 (holo. CAL, iso. CAL, Herb. Presidency College, Calcutta, Herb. A.P. Das).

Plant terrestrial, erect, glabrous, waxy green; *rhizomes* long, internodes 1.8–6.5 × c.0.2cm. *Pseudobulbs* small, ovoid, obscurely lobed, 1.2–1.5 × 0.9–1.2cm. *Leaves* (1–)2, alternate, entire, obtuse to acuminate, slightly caudate, fleshy, whitish-green, 6–7.2 × 4–4.7cm, base sheathing; petioles c.6cm long. *Inflorescence* laxly up to 10-flowered; peduncle slender, angled; rachis c.6cm long; floral bracts lanceolate, acuminate, c.0.5cm long. *Flowers* with deep brown lip. *Sepals* and *petals* similar, linear, c.6mm long. *Lip* oblong, flat, with a broad, shiny central vein, c.8 × 6mm; apex obscurely 3-lobed. *Column* weakly curved, hood-like, c.3mm long.

Darjeeling (Tiger Hill (Das & Chandra, 1988)). 2500m. Fl. July.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. From Tiger Hill, near Darjeeling, where the type specimen was found.

NOTES. This species is related to *L. rostrata* Rchb. f. and *L. odorata* but is a much smaller plant with different leaves and very small flowers. The bracts are narrowly lanceolate and acuminate, and the lip is deep brown with obscure terminal lobes (Das & Chandra, 1988).

Section **Cestichis** Thouars ex Lindl., Gen. Sp. Orchid. Pl.: 29 (1830).

Seidenfaden (1976a) used section *Coriifoliae* (Rchb. f. ex Ridley) Hook. f. for the following species. Rasmussen (1979) pointed out that the correct name for this group was section *Cestichis*, and this name was used by Garay & Romero-Gonzales (1999).

11. L. **bistriata** Parish & Rchb. f. in Trans. Linn. Soc. London 30: 155 (1874). Type: Myanmar (Burma), Moulmein, *Parish* 80 (holo. K!).

Liparis saltucola Kerr in Bull. Misc. Inform. Kew 1927: 216 (1927). Type from Thailand.

Plant epiphytic, 12–21cm tall. *Pseudobulbs* tufted, elongate, stem-like, 2–8 × 0.3–0.9cm. *Leaves* 2, from apex of pseudobulb, subcoriaceous, elliptic, elliptic-lanceolate to elliptic-oblong, acute to subacute, narrowed to base, sessile, 6–11 × 1.5–2.5cm. *Inflorescence* laxly many-flowered; peduncle short, stout, ebracteate, margined or winged, 4–9cm long; rachis 6–9cm long; floral bracts lanceolate, acute, 4–6mm long. *Flowers* 2–4mm long, uniformly pale green or yellow; pedicel and ovary 3–7mm long. *Sepals* similar, linear-oblong, obtuse, spreading, margins revolute, 3–4mm long. *Petals* linear, reflexed, margins revolute, 4–5mm long. *Lip* quadrate-oblong to panduriform, recurved below the middle, c.5 × 1.5–2mm; base with 2 indistinct, confluent calluses; apex truncate, emarginate, minutely erose. *Column* slightly curved, c.3mm long, wings narrow, rounded near the apex, base broad.

Sikkim (Nanga, Tendong). 900–1650m. Fl. July–August.

GENERAL DISTRIBUTION. NE India, Myanmar, China (Yunnan).

ETYMOLOGY. From the Latin *bi-* (two) and *striatus* (striped).

12. **L. bootanensis** Griff., Itin. Pl. Khasyah Mts.: 98 (1848); Not. Pl. Asiat. 3: 278 (1851). Type: Bhutan, Durunga?, *Griffith* 1460 (holo. K-LINDL!).

L. lancifolia Hook. f., Icon. Pl. ser.3 (19): t.1855 (1889); Fl. Brit. India 5(2): 700 (1890). Types: India, Khasia, *Hooker & Thomson* s.n. (syn. K!, isosyn. C!); Khasia, *Mann* s.n. (syn. K!); Khasia, *Clarke* 44641 (syn. K!).

L. subplicata T. Tang & F.T. Wang in Acta Phytotax. Sin. 12(1): 40 (1974). Type: China, Hainan, *Tso & Chun* 44150 (holo. PE).

L. ruybarrettoi S.Y. Hu & Barretto in Chung Chi J. 13(2): 22 (1976). Type: China, Hong Kong, *S.Y. Hu* 12569 (holo. K!, iso. A CUH LE! US).

L. pterostyloides Szlachetko in Fragm. Florist. Geobot. 38(2): 454 (1993). Type: China, Kwang-Tung, *Taam* 455 (holo. P).

Plant epiphytic, 16–30cm tall; *roots* long, narrow. *Pseudobulbs* narrowly cylindric, tapering, 2–3 × 0.6–0.8cm; sheaths overlapping, lanceolate, acuminate. *Leaf* 1, from apex of pseudobulb, linear-oblong to oblanceolate, acute, 7-veined, narrowed to sessile or shortly petiolate base, 15–21 × 2–2.5cm. *Inflorescence* laxly 12- to 20-flowered; peduncle ebracteate; rachis 7–9cm long; floral bracts linear-lanceolate, acute, 6–7mm long. *Flowers* 4–5mm long, pale brown to pinkish white, column whitish, anther green; pedicel and ovary 0.7–1cm long. *Sepals* subsimilar, linear-lanceolate, 1-veined, 4–6.6 × 0.5–1.5mm; *dorsal sepal* weakly reflexed, edges revolute; *lateral sepals* projecting beyond the lip. *Petals* linear, obtuse, decurved, edges revolute, 5–7 × 0.4–0.5mm. *Lip* wedge-shaped to oblong, deflexed from below the middle, 5–6 × 2–3.4mm; base 2-auriculate with 2 erect, globose to tooth-like calluses; apex broad, truncate, mucronate. *Column* curved, 1.9–3mm long, with 2 long, subpendent, elongate hook-like wings at apex. *Fruit* obovoid, stalked, c.8 × 5mm; stalk c.6mm long. **Fig. 49.**

Bhutan: S – Deothang district (Narfong (M.F.B.)); **C** – Thimphu (Dochu La) and Punakha (Tashitang) districts; **N** – Upper Mo Chu district (Kencho); **Darjeeling** (on road from Darjeeling to Rambi; unlocalised *Gamble* specimens); **Sikkim** (Gangtok to Shagyong). 1500–2100m. Fl. June–August.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand, Vietnam, Japan, Malaysia and the Philippines.

ETYMOLOGY. From Bhutan (commonly spelt 'Bootan' by the British in the nineteenth century).

NOTES. Seidenfaden (1976a) revised this species which as a result, along with *L. nervosa* and *L. cespitosa*, is one of the more widespread species of *Liparis*; a fuller synonymy is to be found there.

13. **L. cespitosa** (Lamarck) Lindl. in Bot. Reg. 11: sub t.882 (1825). Type: Mauritius, *Commerson* s.n. (holo. P-LA!).

Epidendrum cespitosa Lamarck, Encycl. 1: 187 (1783).

Malaxis caespitosa Thouars, Hist. Orchid.: t.90 (1822).

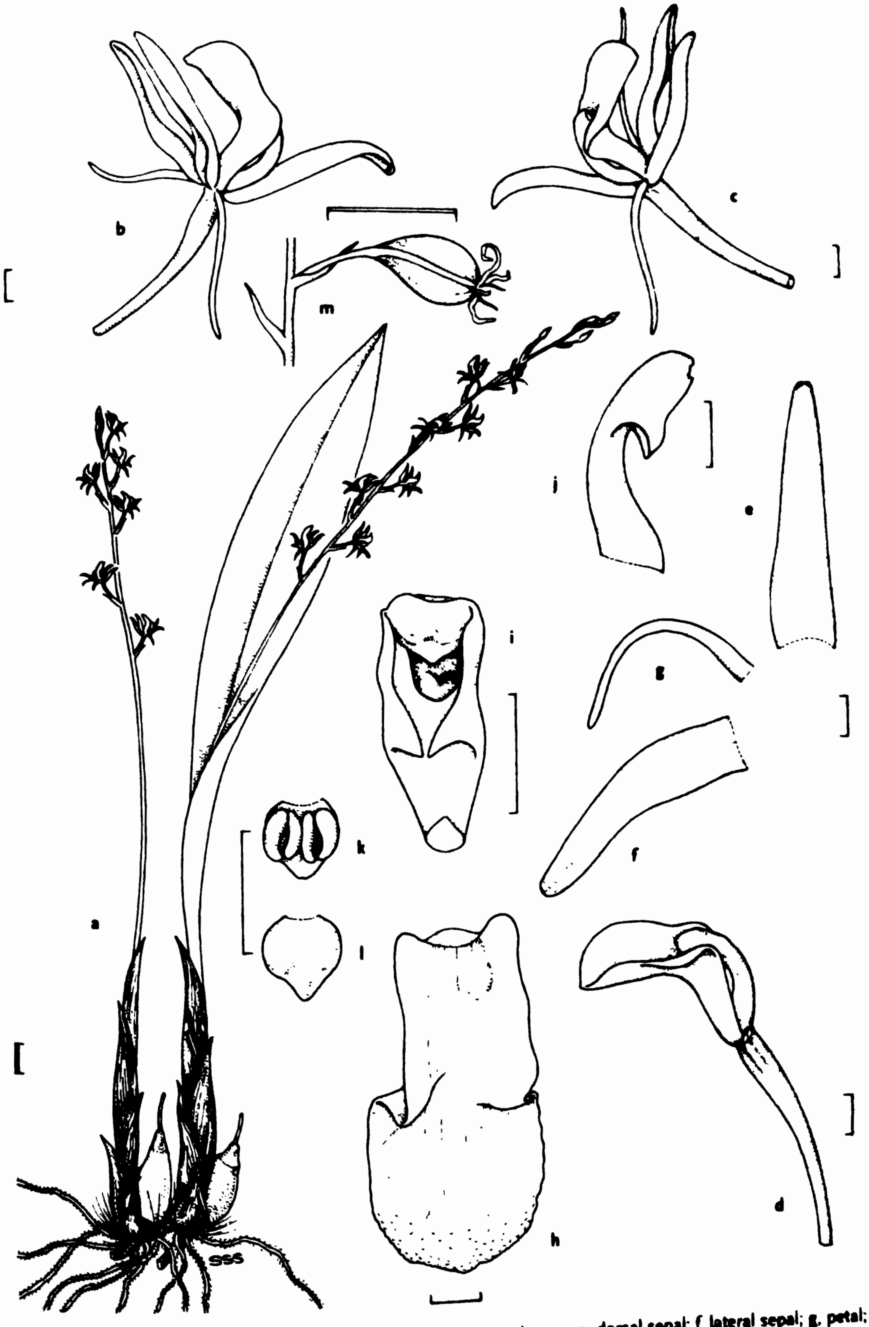


Fig. 49. **Liparis bootanensis**: a, habit; b–c, flower; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column (front view); j, column (side view); k, anther (with pollinia); l, anther (top view); m, fruit. Drawn by Susanna Stuart-Smith, b–l from *Gamble* 10505 (K), a and m from *Griffith* 1460 (K).

L. pusilla Ridley in J. Linn. Soc., Bot. 22: 294 (1886). Type: India, Khasia, *Hooker & Thomson* 92 (syn K-LINDL! K!) and from Anamallays.
L. prainii Hook. f., Icon. Pl. ser.3(19): t.1857A (1889). Type: India, Naga Hills, *Prain* 78 (holo. K!).
L. duthiei Hook. f., op. cit. t.1857B (1889). Type: India, Gori Valley, *Duthie* 24111 (holo. K!).
Cestichis caespitosa (Thouars) Ames, Orchidaceae 2: 132 (1908).
Liparis polanei Gagnepain in Bull. Soc. Bot. France 76: 514 (1929). Type from Vietnam.
L. laurisilvatica Fukuyama in Rep. (Annual) Taihoku Bot. Gard. 3: 83 (1933). Type from Taiwan.

Plant epiphytic, 8–17cm tall. *Pseudobulbs* ovoid, smooth, set close together on the rhizome to form dense mats, green when young, yellowish and wrinkled later, 1–2.5 × c.1cm. *Leaf* 1, from apex of pseudobulb, stiff, oblanceolate, erect, jointed at base, light green, 6–10 × 1–1.5cm. *Inflorescence* densely 20- to 40-flowered; peduncle ebracteate, 3.5–7cm long; rachis glabrous, 4–5cm long; floral bracts lanceolate, acuminate, c.3mm long. *Flowers* non-resupinate, 1.5–2mm long, greenish-yellow to creamy-yellow; pedicel and ovary and c.5mm long. *Sepals* similar, ovate, acute, reflexed; dorsal sepal c.2.5 × 0.5mm. *Petals* linear, obtuse, reflexed, c.2.5mm long. Lip oblong, more or less 4-lobed, apiculate, with 2 small calluses at the base, c.2.5 × 2mm. *Column* curved, less than 1mm long. *Fruit* pendent, long-stalked, ovoid, 5–6.5 × 2.5–3mm.

Bhutan: S – Sarbhang district (Singi Khola); **Darjeeling** (Bhotia Basti to Manibhanjan, Rangit, Sitong); **Sikkim** (Dikchu, 5km NW of Gangtok, Gangtok Orchid Sanctuary, Rimbi Chu, Tista Valley, Rathang Chhu betwen Mintok Khola and Paha Khola). Subtropical terai forest on river bank, on fallen branch in evergreen oak forest; 600–2100m. Fl. July–October.

GENERAL DISTRIBUTION. Widespread from Africa to the Pacific.
ETYMOLOGY. From the Latin *caespitosus* (growing in tufts).
NOTES. Himalayan plants of this species have generally been recorded as *Liparis pusilla* Ridley but we follow Seidenfaden (1976a) in treating them as *L. cespitosa*. Rasmussen (1979) elucidated the taxonomy of this species.

L. duthiei was treated as conspecific by Seidenfaden (1976a) but without giving reasons. The type material of this species consists of very small plants, 3.5–5cm tall with oblong-spathulate leaves 1.5–2.5cm long. We follow Seidenfaden, but feel that further investigation should be undertaken. An extended synonymy can be found in Seidenfaden (1976a).

14. **L. delicatula** Hook. f., Icon. Pl. ser.3(19): t.1889 (1889); Fl. Brit. India 5(2): 705 (1890). Type: India, Churra, Khasia, *Hooker & Thomson* 1109 (holo. K!).
Liparis decurrens sensu Ridley in J. Linn. Soc., Bot. 22: 291 (1887), non (Bl.) Ridley.

Plant epiphytic, 4.5–10cm tall. *Pseudobulbs* clustered, tufted, ovoid to cylindric, slightly compressed, c.5 × 2–3mm. *Leaves* 2, narrowly elliptic, tapered to each end, sessile to shortly petiolate, membranous, 2–3 × 0.4–0.6cm. *Inflorescence* terminal, racemose, laxly few-flowered; peduncle more or less zigzag, bracteolate. 1–2cm long; rachis 4–6cm long; floral bracts ovate-lanceolate, acute, 1–1.5mm long. *Flowers* 2–3mm long, uniformly yellow-ochre, column pale green; pedicel and ovary 1–2mm long. *Sepals* subsimilar, ovate-lanceolate, acute, edges recurved, 2–3mm long; *dorsal sepal* retroflexed; *lateral sepals* falcate, diverging. *Petals* linear, obtuse, decurved, 2–3mm long. Lip orbicular-oblong, 2–3 × 1–1.5mm; base with several short. lateral folds with a central 2-tuberculate nectary; apex recurved, apiculate, hispidulous, margins entire. *Column* stout, curved, c.2mm long, with 2 broadly triangular wings. *Fruit* subglobose, strongly ridged, c.5 × 2.5mm.

Darjeeling (Pankhabari). 1800m. Fl. June.

GENERAL DISTRIBUTION. NE India, China (Yunnan) and Laos.
ETYMOLOGY. From the Latin *delicatus* (delicate, pretty).

15. **L. elliptica** Wight, Icon. Pl. Ind. Orient 5: t.1735 (1852). Type: India, Coonoor, Nilgiri Hills, Wight s.n. (holo. K!).

Liparis wightii Rchb. f. in Walpers, Ann. Bot. Syst. 6: 218 (1861). Type: India, Wight cited above.

L. hookeri Ridley in J. Linn. Soc., Bot. 22: 288 (1886). Type: India, Khasia, Hooker & Thomson 109 (holo. K-LINDL!, iso. K!).

L. concava Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 9: 283 (1911). Type from New Caledonia.

Plant epiphytic, 15–27cm tall. *Pseudobulbs* clustered, compressed, flattened, rugose, ribbed, subrhomboid to globose, 1.5–2.5 × 0.8–1cm. *Leaves* 2, from apex of pseudobulb, oblong to oblanceolate, acute, tapering and shortly petiolate at base, central vein strong, 7.5–14 × 1.5–2.5cm; petiole channelled, 0.3–1cm long. *Inflorescence* laxly to subdensely many-flowered; peduncle compressed, 2-winged, zigzag, bracteate, 7–12.5cm long; peduncle bracts distant, narrowly lanceolate, acute to acuminate, 5–6 × 1–1.5mm; rachis glabrous, winged, 6–13cm long; floral bracts lanceolate, apiculate, 3–5 × 0.8–1.1mm. *Flowers* pendent, 3–4mm long, uniformly greenish; pedicel and ovary curved, glabrous, c.5mm long. *Sepals* similar, oblong, subacute, with a central vein, 3–4 × 1–1.8mm (at base). *Petals* filiform to linear, 3–3.5 × 0.1–0.2mm. Lip suborbicular, irregularly 3-lobed, lobes undulate, tapering to an acute apex, 3–4 × 2–3mm. Column weakly curved, 2–2.2mm long. Fruit pendent, subglobose, ridged, 5–7 × 3–4mm; stalk curved, 3–3.5mm long.

Sikkim (Lusing). In wet temperate forest; 1200–2000m. Fl. October–January.

GENERAL DISTRIBUTION. Sri Lanka, Nepal, India, Myanmar, China, Thailand, Taiwan, Java to New Caledonia and Fiji.

ETYMOLOGY. From the Latin *ellipticus* (elliptic), probably a reference to the leaf shape.

NOTES. Seidenfaden (1976a) reviewed the taxonomic position with reference to the closely related *L. viridiflora*; he also gives a fuller synonymy.

16. **L. lydiae** S.Z. Lucksom in J. Bombay Nat. Hist. Soc. 89(1): 105 (1992). Type: India, Sikkim, Bhusuk Valley, Lucksom 198 (holo. CAL!, iso. Gangtok, Forest Dept. Herb.).

Plant epiphytic, 8–11.5cm tall. *Pseudobulbs* tufted, ovoid-cylindric, sheathed, tapering towards apex, 1–2 × 0.35–0.6cm. *Leaves* 4, thinly membranous, alternate, ovate-oblong, margins entire, 1–2.7 × 0.4–0.9cm. *Inflorescence* subpendent, 4- to 14-flowered; peduncle long, slender, terete, erect, 0.8–2.5cm long; with 2 or 3 cordate, clasping bracteoles, 5–6 × 2–3mm; rachis 8–9cm long; floral bracts small, cordate, base clasping, 5–6 × 2–3mm. *Flowers* 7–8mm long, light greenish-pink, sepals brownish-pink, petals whitish-pink; pedicel and ovary 4–4.5mm long. *Sepals* subsimilar; *dorsal sepal* cordate, retroflexed, 3.6–4 × 2–3mm; *lateral sepals* spreading, oblong, obtuse, margin recurved, 5.2–5.7 × 0.9–1.1mm. *Petals* oblong, obtuse, translucent, margins recurved, 2.9–3.1 × 0.09–0.1mm. Lip cordate, slightly deflexed in middle, 2–2.5 × 0.8–1mm; base with 4 calluses. Column winged, c.3mm long; anther ovate, dome-shaped, c.0.5mm long; pollinia 2, clavate-oblong, c.0.4mm long.

Sikkim (Bhusuk Valley). On branches of shrubs in moist and shady places; 900–1200m. Fl. October–November.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. Named after Lucksom's mother who had inspired his study of orchids.

NOTES. Lucksom (1992) stated that this species was closely related to *L. platyrachis* but differed as follows: pseudobulbs ovoid-cylindric, rather than oblong; flowers greenish-pink, rather than ochraceous-yellow; dorsal sepal broader (not narrower) than the lateral sepals; lip cordate, rather than quadrate.

17. **L. mannii** Rchb. f. in Flora: 275 (1872). Type: India, Upper Assam, *Mann* 27 (holo. W! Herb. no. 46235).

Liparis tenuifolia Hook. f., Fl. Brit. India 6(1): 182 (1890); Icon. Pl. ser.4 (21): t.2013 (1892). Type: India, Assam, Mikir Hills, *Mann* 30 (holo. K!).

Plant epiphytic, 20–27cm tall. *Pseudobulbs* crowded, narrowly ovoid, compressed, enveloped in ovate-lanceolate, acute, scarious sheaths, 1.2–3 × 0.5–0.9cm. *Leaf* 1 from apex of pseudobulb, linear-oblong, acute, narrowed to a convolute, sessile base, 10–25 × 0.5–1.1cm. *Inflorescence* densely many-flowered; peduncle slender, flattened, narrowly 2-winged, 9–11cm long; rachis 5.5–16cm long; floral bracts linear-lanceolate, 1–2mm long. *Flowers* non-resupinate, c.2mm long, uniformly yellowish-green; pedicel and ovary slender, curved upwards, 1.5–3mm long. *Sepals* subsimilar, oblong, reflexed, margins recurved; *dorsal sepal* subacute, 1–1.5mm long; *lateral sepals* obtuse, 1–1.5mm long. *Petals* linear, obtuse, reflexed, c.1mm long. *Lip* 3-lobed, ecallose, c.1 × 0.6mm; base parallel to the column; lateral lobes broad, erect, falcate, porrect; apex decurved, rhombic, acute, margins erose. *Column* terete, c.1mm long, lacking wings, base dilated.

Duars (E of Jaldhakar). 300m. Fl. December.

GENERAL DISTRIBUTION. NE India, China and Vietnam.
ETYMOLOGY. Named after the German botanist Gustav Mann (1836–1916) who worked for the Indian Forest Service between 1863 and 1891.
NOTES. King & Pantling (1898) noted the close relationship of this species to *L. tenuifolia* Hook. f. and many of the Himalayan plants have been reported under this name. Seidenfaden (1976a) reviewed the taxonomy and treated them as conspecific.

18. **L. perpusilla** Hook. f., Icon. Pl. ser.3(19): t.1856B (1889); Fl. Brit. India 5(2): 706 (1890). Types: India, Sikkim Himalaya, *Hooker* 110 (syn. K-LINDL!, isosyn. K!); Darjeeling, *Clarke* 26872 (syn. K!, isosyn. W!); Darjeeling, Senchal, *Gamble* 9421 (syn. K!).

Liparis togashii Tuyama ex Hara, Fl. E. Himal.: 441 (1966). Type: E Nepal, Hati Sar–Minchin Dhap, *Hara, Kanai, Kurosawa, Murata, Togashi & Tuyama* 6305488 (holo. TI!, iso. TI!).

Plant epiphytic, 2.5–9cm tall. *Pseudobulbs* tufted, ovoid-cylindric, 8–12 × 2–2.5mm. *Leaves* 3 or 4, from upper part of pseudobulb, linear to linear-oblanceolate, acute, midrib strong, 1–3 × 0.1–0.2cm. *Inflorescence* laxly 5- to 14-flowered; peduncle 2-bracteolate, 1.5–5cm long; rachis 1.5–4cm long; floral bracts lanceolate, acute, 2–2.5mm long. *Flower* to 3mm wide, uniformly yellow; pedicel and ovary 3–5mm long. *Sepals* similar, broadly elliptic-oblong, obtuse, spreading, c.1.5mm long. *Petals* linear, obtuse, reflexed, c.1.5mm long. *Lip* quadrate, deflexed at middle, deeply grooved from base to apex, 1–1.5mm long; base with a small, crescentic nectary and 2 elongate, divaricating calluses; apex broadly round. *Column* thick, c.1mm long, with 2 short, triangular wings at apex, base broad.

Bhutan: S – Chukka district (N of Jumudag); **Darjeeling** (Sandakphu to Tonglu, Senchal); **Sikkim** (Chunthang, Lachen, Lachung Valley). On *Quercus lamellosa* in evergreen oak forest; 1800–3970m. Fl. July–August.

GENERAL DISTRIBUTION. Nepal, NE India.
ETYMOLOGY. From the Latin *perpusillus* (exceptionally small).
NOTE. This species can be distinguished from the related *L. platyrachis* and *L. delicatula* by the longer pedicel and ovary which give the inflorescence a more open appearance.

19. **L. plantaginea** Lindl., Gen. Sp. Orchid. Pl.: 29 (1830). Type: India, sine loc., icon. Wallich 633 (holo. K!).

Liparis selligera Rchb. f. in Linnaea 41: 42 (1877). Type: India, cult. Sander (holo. W! Herb.no. 39791).
L. orbicularis Loddiges ex Hemsley in Gard. Chron. n.s. 16: 592 (1881), nom. nud.
L. griffithii Ridley in J. Linn. Soc., Bot. 22: 285 (1886), p.p. Type: Bhutan?, *Griffith* 5069 p.p. (holo. K!).

Plant epiphytic, 27–35cm tall. *Pseudobulbs* narrowly ovoid-cylindric, compressed, smooth, pale green, 2.5–6 × 1–1.5cm (at base); covered with 4 or 5 large, membranous, overlapping sheaths. *Leaves* 2, subopposite, sessile to petiolate, oblong-elliptic to oblanceolate-oblong, acute, 5- to 7-veined, keeled, 19–22 × 3.5–4cm. *Inflorescence* laxly up to 15-flowered; peduncle compressed, 9–11cm long; rachis 8–13cm long; floral bracts concave, ovate-lanceolate, acute to apiculate, 0.7–1.5 × 0.15–0.3cm. *Flowers* up to 1cm long and wide, uniformly green; pedicel and ovary 1–1.5cm long. *Sepals* similar, oblong-lanceolate, subacute, margins revolute, 0.8–1 × 1.5–2.5cm; *dorsal sepal* spreading; *lateral sepals* parallel, under the lip. *Petals* decurved, linear, revolute, c.1cm long. *Lip* large, concave, clawed, suborbicular, margins erose-dentate, decurved near base, 0.8–1 × 0.7–0.9cm; callus 2-lobed. *Column* curved, c.3mm long, with 2 small, angular apical wings, thickened at base. *Fruit* ridged, c.1cm long.

Bhutan: C – Tashigang district (near Tashi Yangtsi (M.F.B.)); **Darjeeling** (Ryang, Selim); **Sikkim** (Tendong). In tropical valleys; 1800–2000m. Fl. June–September(–October); Fr. November.

GENERAL DISTRIBUTION. India, Thailand and Vietnam.
ETYMOLOGY. From the Latin *plantagineus* (plantain-like) a reference to the similarity of the leaves to those of the European plantain (*Plantago*).
NOTE. L. *griffithii* Ridley is based on a mixed collection. One of the plants, collected in Assam, is conspecific with this species, the other is a synonym of L. *stricklandiana* (Seidenfaden, 1976a).

20. L. **platyrachis** Hook. f., Icon. Pl. ser.3(19): t.1890 (1889); Fl. Brit. India 5(2): 706 (1890). Types: India, Sikkim Himalaya, *Treutler* 967 (syn. K!); Sikkim, Champoong, *Clarke* 25109 (syn. K!); Sikkim, Tendong, *Clarke* 25141 (syn. K!); Sikkim, Yoksam, *Clarke* 25153 (syn. K!).

Plant epiphytic, 4.5–14cm tall. *Pseudobulbs* tufted, cylindric, compressed, 1–1.5 × 0.3–0.4cm. *Leaves* 3–5, linear-lanceolate, acute, base sessile, sheathing, 2.5–4 × 0.3–0.5cm. *Inflorescence* pendent, elongate, many-flowered; peduncle intermittently winged, bracteolate, 2–4cm long; rachis winged, 5–11cm long; floral bracts linear, 1–2 × 0.3–0.4mm. *Flowers* 4–5mm wide, uniformly pale yellow-ochre, column and base of lip pale green; pedicel and ovary suberect to horizontal, 3–5mm long. *Dorsal sepal* elliptic (when spread), obtuse, 1-veined, 2.5–3 × 0.8–1mm; *lateral sepals* elliptic (when spread), subacute, margins recurved, 3-veined, 2–3 × 0.4–0.5mm. *Petals* linear, obtuse, decurved, margins revolute, 1-veined, 2–3 × 0.05–0.1mm. *Lip* quadrate to subpandurate, deflexed at the middle, 1.8–2 × 0.8–1.1mm; base with 4 calluses, 2 conical, erect, lateral to nectary, 2 triangular, depressed; apex broad, round, apiculate. *Column* 1–1.5mm long, with a small, triangular wing each side of the stigma, base dilated, flattened. *Fruit* c.8 × 6mm.

Sikkim (Champoong?, Chunthang, Tendong, Yoksam). 1200–1800m. Fl. September–October.

GENERAL DISTRIBUTION. Nepal, NE India and China (Yunnan).
ETYMOLOGY. From the Greek *platy*- (wide, broad) *rachis* (rachis).
NOTE. Closely related to L. *delicatula* but differs in having a lip with 4 calluses and a flattened column base.

21. L. **resupinata** Ridley in J. Linn. Soc., Bot. 22: 290 (1886). Types: India, Darjeeling, *Griffith* s.n. (syn. K-LINDL!); Khasia and Mumbree, *Griffith* 5082 (syn. K!); Khasia Hills, *Lobb* 122 (syn. K-LINDL!); Sikkim, *Hooker* 90 (syn. K-LINDL!).
Liparis ridleyi Hook. f., Icon. Pl. ser.3(19): t.1887 (1889); Fl. Brit. India 5(2): 705 (1890). Types: India, Sikkim, *Hooker* 89 (syn. K-LINDL!, isosyn.K!); Sikkim, *Hooker* 95 (syn. K-LINDL!).
L. *resupinata* var. *ridleyi* King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 37, t.49 (1898). Type: India, Sikkim, *Pantling* 201 (holo. CAL, iso. E! K! W!).

Plant epiphytic, 12–28cm tall. *Pseudobulbs* tufted, ovoid-cylindric, sheathed, 1.5–2.5 × 0.3–0.4cm. *Leaves* 2–4, alternate, membranous, linear-lanceolate, acute to acuminate, sessile, 6–13 × 0.4–0.8cm.

Inflorescence laxly many-flowered; peduncle slender, zigzag, bracteolate, 5–8cm long; rachis 8–18cm long; floral bracts lanceolate, acute, concave, 3–4 × 1–1.5mm. *Flowers* c.2 × 5mm (wide), uniformly golden-brownish to creamy; pedicel and ovary c.5mm long. *Sepals* subsimilar, oblong, obtuse, 3–4 × c.1mm; *dorsal sepal* retroflexed; *lateral sepals* spreading, margins recurved. *Petals* linear, obtuse, spreading, 2–3mm long. *Lip* broadly oblong to ovate, sagittate basally, c.3mm long; apex obtuse, margins incurved, pouched; calluses 2, at base. *Column* 1–2mm long, 2-winged, with a pendent, filiform process from each wing. *Fruit* obovoid, 5–6 × 3–4mm. **Plate 7.**

Bhutan: S – Samchi (Sangura (M.F.B.)), Phuntsholing (Kamji (M.F.B.)) and Chukka (N of Jumudag) districts; C – Punakha district (Chachuphu); **Darjeeling** (Dumsong, Munsang); **Sikkim** (Chakung Chhu, Dentham, Penlang La to Gangtok). In evergreen oak forest, on *Quercus lamellosa*; 1500–2420m. Fl. October–March; Fr. May.

GENERAL DISTRIBUTION. India (Himalayas), Nepal and China.
ETYMOLOGY. From the Latin *resupinatus* (resupinate).
NOTE. In the protologue Ridley listed a specimen from the Nilgiri Hills (Wight) but this record was an error.

22. **L. somai** Hayata, Icon. Pl. Formos. 4: 33, t.6 (1914). Type: Taiwan, Kusukuru, T. *Soma* s.n. (holo. TI).
Cestichis somai Hayata, Icon. Pl. Formos. 4: 33 (1914), *nom. nud. in syn.*

Liparis sikkimensis S.Z. Lucksom & S. Kumar in J. Indian Bot. Soc. 73: 159 (1994), **syn. nov.** Type: India, Sikkim, Dikchu, S.Z. *Lucksom & S. Kumar* 197 (holo. CAL, iso. Gangtok Forest Dept. Herb.).

Plant epiphytic, 12–17.5cm tall. *Pseudobulb* ovoid, smooth, enveloped in 3 or 4 sheaths, 3.2–4.5 × 1.7–2.5cm; sheaths 0.5–5cm long. *Leaves* 2, apical, narrowly elliptic-oblong, mucronate, many-veined, tapering towards base, 9.5–14 × 1.8–2.8cm. *Inflorescence* erect, many-flowered; peduncle winged, smooth, 4.5–6.5cm long; peduncle bracts linear-lanceolate, 2.2–4.5mm long; rachis angular, 5–7.5(–10)cm long; floral bracts linear-lanceolate, acuminate, 3.5–4(–5) × 0.3–0.4(–1)mm. *Flowers* glabrous, 4–4.5mm long; sepals and petals white, lip yellowish-white, column pale green. *Sepals* subequal, spreading; *dorsal sepal* oblong, obtuse, revolute, reflexed, 2.2–2.5(–3) × 0.5–0.6(–1)mm; *lateral sepals* ovate, subacute, revolute, 2.2–2.5(–3) × 0.8–1(–1.5)mm. *Petals* oblong, obtuse, 1.8–2(–3) × 1.5mm. *Lip* simple, narrowly oblong, obtuse, deflexed from the middle, ecallose, 2(–3) × 2mm. *Column* terete, slightly curved, 1.5–1.6mm long.

Sikkim (Dikchu (Lucksom & Kumar, 1994)). On *Shorea robusta* and *Schima wallichii*; 450–1050m. Fl. October–December; Fr. Januuary–February.

GENERAL DISTRIBUTION. China and Taiwan.
ETYMOLOGY. Named after T. Soma who collected the type specimen.
NOTES. Lucksom & Kumar (1994) stated that their *L. sikkimensis* was closely related to *L. elliptica* but differed in having larger pseudobulbs, creamy-white, rather than green, flowers, smaller petals, and the lip narrowly oblong, obtuse, deflexed with entire margins, rather than suborbicular, infolded, with crenulate margins. Based on this we believe it to be indistinguishable from the Taiwanese *L. somai* and therefore reduce it to synonymy here.

23. **L. stricklandiana** Rchb. f. in Gard. Chron. n.s., 13: 232 (1880). Type: India, Assam, 'Parimo', *Mann* s.n. (holo. W! Herb. no. 46288).
Liparis chloroxantha Hance in J. Bot. 21: 231 (1883). Type: China, Hong Kong, *Ford* 22170 (holo. HK).
L. griffithii Ridley in J. Linn. Soc., Bot. 22: 285 (1886) *p.p.* Type: Bhutan, *Griffith* 5069 *p.p.* (holo. K!).
L. dolabella Hook. f., Fl. Brit. India 6(1): 183 (1890); Icon. Pl. ser.4(21): t.2010 (1892). Type: India, Khasia Hills, *Mann* 25 (holo. K!).
L. malleiformis W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 13: 212 (1921). Type: China, Yunnan, *Forrest* 17679 (holo. E!).
L. stricklandiana var. *longibracteata* S.C. Chen in Acta Phytotax. Sin. 21(3): 345 (1983). Type: China, Yunnan, Malipo, *C.W. Wang* 83920 (holo. PE).

Plant epiphytic, 21–32cm tall. *Pseudobulbs* ovoid-cylindric, compressed, 2–3 × 0.7–1cm. *Leaves* 2, narrowly oblanceolate, acute, 5-veined, attenuate towards base, 19–30 × 1.4–2.5cm. *Inflorescence* fairly densely many-flowered; peduncle arising from between the leaves, flattened, winged, with 1 or 2 linear bracteoles, 14–17cm long; rachis 6–9cm long; floral bracts linear, acute to acuminate, 6–7 × 1mm wide (at base). *Flowers* to 4mm long, uniformly yellowish-green; pedicel and ovary 5–7mm long. *Sepals* subsimilar, oblong, obtuse, margins recurved, 4–5 × c.1mm; *dorsal sepal* reflexed; *lateral sepals* broader, spreading. *Petals* linear, obtuse, spreading, c.7mm long. *Lip* broadly obdeltoid, strongly recurved from near base, c.6 × 4mm; callus 1, near column base; apex broad, truncate, minutely erose. *Column* slender, wingless, 3–4mm long. *Fruit* cylindric, ridged, c.6 × 3mm.

Bhutan: C – Tashigang district (Tashi Yangtsi (M.F.B.)); **Sikkim** (Pemayangtse). 1350–1800(–2000)m. Fl. (September–)October–December; Fr. September.

GENERAL DISTRIBUTION. NE India and China.
ETYMOLOGY. Named after a Mr Strickland who flowered the type collection and gave it to Reichenbach.
NOTE. Seidenfaden (1976a) revised the taxonomy of this species which, in the Himalayas, had previously been reported as L. *griffithii* Griff.

24. **L. viridiflora** (Bl.) Lindl., Gen. Sp. Orchid. Pl.: 31 (1830). Type: Java, Tjanjor, *Blume's collector* s.n. (holo. L! Herb. no. 90316728).
Malaxis viridiflora Bl., Bijdr.: 392 (1825).
Liparis longipes Lindl. in Wall., Pl. Asiat. Rar. 1: 31, t.35 (1830). Types: Sri Lanka (Ceylon), *Macrae* 20 (syn. K!); Bangladesh, Sylhet, icon. Wallich 176 (syn. K!).
Sturmia longipes (Lindl.) Rchb. f. in Bonplandia 3: 250 (1855).
Liparis longipes var. *spathulata* (Lindl.) Ridley in J. Linn. Soc., Bot. 22: 294 (1886).
Leptorchis viridiflora (Bl.) Kuntze, Revis. Gen. Pl. 2: 671 (1891).
L. longipes (Lindl.) Kuntze, loc. cit. (1891).
Cestichis longipes (Lindl.) Ames, Orchidaceae 1: 75 (1905).
Liparis pleistantha Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 64 (1919). Type: China, Yunnan, *Henry* 12640 (holo. K!).

Plant terrestrial or epiphytic, 15–25cm tall. *Pseudobulbs* clustered, stem-like, ovoid at base, long-cylindric above, green, 10–15 × 1–1.5cm (at base) and 0.3–0.5cm above. *Leaves* 2, obovate-oblong to oblanceolate, obtuse, acute or acuminate, 10–30 × 2–5cm. *Inflorescence* cylindric, slender, densely many-flowered, with a few bracts below the raceme; peduncle glabrous, 4–10cm long; rachis glabrous, 10–17cm long; floral bracts lanceolate, acuminate, scarious, 3–6 × 0.5–0.75mm. *Flowers* 4–5mm across; sepals and petals white with a yellow lip; pedicel and ovary slender, slightly curved, 5–6mm long. *Sepals* similar, revolute, linear to oblong, free, obtuse, 2.5–3 × 0.6–0.8mm. *Petals* linear, subacute, spreading to reflexed, 2–2.5 × 0.3–0.4mm wide. *Lip* simple, recurved, broadly ovate, subacute, rather fleshy, ecallose, 2.5–3 × 1.5–2mm wide. *Column* incurved, 1.4–1.6mm long, wings rounded. *Fruit* ridged, stalked, 4–6 × 2–4mm; stalk 4–5mm long.

Bhutan: S – Samchi (Sangura (M.F.B.)), Gaylegphug (Gaylegphug (M.F.B.)) and Deothang (Deothang) districts; C – Punakha (Bhotokha to Punakha, near Rimchu) and Tashigang (near Tashi Yangtsi) districts; **Darjeeling** (Chota Rangit River, Dumsong, Kurseong); **Sikkim** (Tista Valley). In dense forest on tree trunks, on *Acer cappadocicum*, in tropical valleys, on river banks; (270–)450–1600m. Fl. October–November; Fr. December.

GENERAL DISTRIBUTION. Sri Lanka, India, Nepal, Thailand, China to Indo-China and Malaysia.
ETYMOLOGY. From the Latin *viridis* (green) and *flos* (flower).
NOTE. Himalayan material has generally been referred to by the name L. *longipes* Lindl. but we follow Seidenfaden (1976a) in treating it as conspecific with L. *viridiflora*.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

L. assamica King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 36, t.53 (1898). Types: India, Khasia Hills, *Griffith* 5082 (syn. CAL!, isosyn. K!); Khasia Hills, *Mann* 21 (syn. CAL!).

NOTES. *L. assamica* was first described by King & Pantling (1898) based on collections by Mann, Wallich and Griffith from Khasia. It is closely related to *L. resupinata* but differs in having a column lacking prominent pointed wings and a differently shaped lip. Seidenfaden (1976a) cited a collection (*Watt* 607, K) as the lectotype but this was unnecessary because the type material (apart from the Wallich material which has not been found) is in CAL. It has not been reported from Bhutan, Darjeeling or Sikkim. Chowdhery (1998) reported it from the Kameng district in Arunachal Pradesh.

L. distans C.B. Clarke in J. Linn. Soc., Bot. 25: 71, t.29 (1889). Types: India, Nagaland, Kohima, *Clarke* 41071 (syn. K!); Kohima, *Clarke* 41099 (syn. K not found); Kohima, *Clarke* 41105 (syn. K!); Kohima, *Clarke* 41574 (syn. K!).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

L. gibbosa Finet in Bull. Soc. Bot. France 55: 342, t.11 (1908). Type: Java, *Blume* s.n. (holo. P!, iso. L!).
Liparis gregaria Lindl., Gen. Sp. Orchid. Pl.: 33 (1830). Type from Sri Lanka (Ceylon).

NOTE. Bose & Bhattacharjee (1980) reported (and included an illustration) of *L. gibbosa* from Sikkim and Chumbi. We consider that this report may have been based on a misidentification.

L. luteola Lindl., Gen. Sp. Orchid. Pl.: 32 (1830). Type: Bangladesh, Pandua, coll. F. *De Silva* Wall. Cat. 1944 (holo. K-LINDL!, iso. K! K-W!).

NOTE. Reported by Rao & Deori (1980) from Salari in the Kameng district of Arunachal Pradesh.

49. **Malaxis** Solander ex Sw.

Plants terrestrial, lithophytic or epiphytic, caespitose or with a distinct rhizome, occasionally mycotrophic and leafless. Stem modified into a leafy pseudobulb, fleshy. *Leaves* 1 to several, membranous to fleshy, plicate to conduplicate, sometimes petiolate. *Inflorescence* terminal, pedunculate, racemose to subumbellate, laxly to densely many-flowered. *Flowers* small to minute, non-resupinate. *Sepals* free, subequal, spreading; lateral sepals often connate at base. *Petals* filiform, coiled. Lip free from column, sessile, entire or lobed, basally cordate or auriculate. Column short, lacking a foot; pollinia 4, waxy, lacking a caudicle or viscidium; stigmas transverse, confluent.

The genus *Malaxis* was established in 1788 by O. Swartz in his *Nova Genera et Species Plantarum* and is considered congeneric with *Microstylis* (Nuttall) Eaton (1822). The genus comprises about 300 species distributed throughout the world but more frequently in SE Asia and the adjacent islands.

Ridley (1888) first revised the genus and proposed a sectional treatment. Schlechter (1911) revised the New Guinea species proposing nine sections, while Seidenfaden (1978b) revised the Thai species recognising six sections. Hill & Blaxell (1985) reinstated section *Hololobus* for certain Asiatic species, a treatment followed by Seidenfaden (1995a).

Szlachetko (1995) transferred the majority of species from *Malaxis* Sw. into a number of other genera. Clements & Jones (1996) noted that this work lacked a critical circumscription of *Malaxis sensu* str., failed to give key generic characters and introduced some errors. They, however, supported the transfer of some species to the reinstated genus *Crepidium* Bl. and Seidenfaden (1997) followed this for certain species. This treatment may be correct, but we prefer to retain *Malaxis* as used by Schlechter until a full monographic treatment has been undertaken.

Reeves & Reeves (1984) reported that the flowers of the closely related *Hammarbya paludosa* (L.) Kuntze (syn. *M. paludosa* (L.) Sw.) in Minnesota were visited by the male fungus gnat *Phronia digitata*. The insect enters the flower from below, reaches over the column to probe for nectar at the base of the lip, thereby contacting the pollinial glue which attaches the pollinia behind the insect's mouthparts. These observations confirm the mechanism proposed by Darwin (1862).

LECTOTYPE. *Malaxis spicata* Sw.

ETYMOLOGY. From the Greek *malaxis* (softening) in reference to the soft texture of the leaves.

Key to species

1. Lip with auricles stretching backwards from base on both sides of the column 2
+ Lip lacking backward-stretching auricles at base 9

2. Plant mycotrophic, lacking leaves 3
+ Plant autotrophic, with leaves 4

3. Lip flat, apex rounded; dorsal sepal erect .... **2. M. aphylla**
+ Lip folded, weakly saccate, apex acute; dorsal sepal reflexed .... **8. M. saprophyta**

4. Lip with a prominent central constriction .... **5. M. khasiana**
+ Lip lacking a prominent central constriction 5

5. Lip slightly convex with large, sagittate basal auricles 6
+ Lip hooded to deeply saccate with short, round basal auricles 8

6. Lip apex square-truncate with a central triangular projection with triangular basal auricles; leaves variegated .... **3. M. calophylla**
+ Lip apex rounded, with a small central indentation with rounded basal auricles; leaves not variegated 7

7. Sides of apical part of lip with an uninterrupted edge from base to apex ..... **1. M. acuminata**
+ Sides of apical part of lip with an indentation separating the 2-lobed apex from the low lateral lobes .... **7. M. purpurea**

8. Flowers more than 1cm; inflorescence lax .... **4. M. josephiana**
+ Flowers less than 0.2cm; inflorescence dense .... **6. M. maximowicziana**

9. Lip apex 3-lobed .... **11. M. ophrydis**
+ Lip apex simple, acute, not 3-lobed 10

10. Plant with 1 leaf .... **9. M. cylindrostachya**
+ Plant with 2 leaves .... **10. M. muscifera**

Section **Hololobos** (Schltr.) K. Hill & D. Blaxell in Orchadian 8(4): 80–82 (1985).

1. M. acuminata D. Don, Prodr. Fl. Nepal.: 29 (1825). Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 1938.1 (holo. BM!).

Microstylis wallichii Lindl., Gen. Sp. Orchid. Pl.: 20 (1830). Types: Nepal, coll. *Wallich* Wall. Cat. 1938.1

(syn. K-LINDL!, isosyn. K-W!); Bangladesh, Sylhet, coll. F. *De Silva* Wall. Cat. 1938.2 (syn. K-LINDL! K-W!).

M. biloba Lindl. in Wall. Cat.: 1940.1 (1829); loc. cit. (1830). Type: Nepal, Wall. Cat. 1940.1 (syn. K-LINDL!, isosyn. K-W!); Myanmar (Burma), Taong Dong, coll. *Wallich* Wall. Cat. 1940.2 (syn. K-LINDL!, isosyn. K-W!).

Malaxis biloba (Lindl.) Ames, Orchidaceae 2: 112 (1908).

Microstylis trigonocardia Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 62 (1919). Type: China, Yunnan, *Henry* 12284 (holo. B†, iso. K!).

Malaxis acuminata var. *biloba* (Lindl.) Ames, Enum. Philipp. Fl. Pl. 18: 302 (1925).

Malaxis wallichii (Lindl.) Deb in Bull. Bot. Surv. India 3: 128 (1962).

M. acuminata f. *biloba* (Lindl.) Tuyama in Hara, Fl. E. Himal.: 443 (1966).

M. allanii S.Y. Hu & Barretto in Chung Chi J. 13(2): 18, t.9 (1976). Type: China, Hong Kong, *S.Y. Hu* 13551 (holo. K!, iso. A, CUH).

Crepidium acuminatum (D. Don) Szlachetko in Fragm. Florist. Geobot. suppl. 3: 123 (1995).

Plant terrestrial or lithophytic, 14–30cm tall; *roots* fasciculate, slender, c.1mm wide. *Stem* glabrous, sheathed at base. *Leaves* 3 or 4, thinly membranous, ovate-lanceolate, acute to acuminate, narrowed to sheathing base, petiolate, margins undulate, 5.5–12 × 2.5–6cm; petiole 3–4cm long. *Inflorescence* racemose, laxly many-flowered; peduncle ribbed, 13–28cm long; rachis glabrous, 4–8cm long; floral bracts lanceolate, subacute, reflexed, 3–4mm long. *Flowers* 5–8mm long, uniformly yellowish-green, yellow tinged with red-purple or pink-purple; pedicel and ovary linear, 5–7mm long. *Sepals* subsimilar, oblong, margins recurved, 5–6mm long; *dorsal sepal* linear-oblong, subacute; *lateral sepals* broadly oblong, obtuse. *Petals* linear, obtuse, margins recurved, 4–5mm long. *Lip* slightly convex, narrowly ovate-sagittate, 6–7 × 4–5mm (when flattened); base divided into 2 broad to lanceolate lobes, inner margins separated, straight and parallel; apex flat, incurved at the notch. *Column* fleshy, c.1mm long. **Plate** 7.

214 **Bhutan:** S – Phuntsholing (below Suntlakha) and Chukka (3km S of Chima Kothi, Chukka) districts; C – Mongar district (Khoma); **Darjeeling** (near Badamtam, E Birch Hill Road, Kalimpong, 1km S of Lebong Cantonment, Observatory Hill, Senchal, Sureil, Takdah?); **Sikkim** (Gangtok to Temi (F.E.H.2), 10km S of Rabang La). On dry bank in disturbed area cleared from broad-leaved forest, in ground layer in shady evergreen *Castanopsis* forest, on steep hill with tall bamboo; 800–2300m. Fl. June–August.

GENERAL DISTRIBUTION. India, Nepal, China, Thailand, Myanmar, Vietnam, Malaysia, Sumatra, Java and the Philippines.

ETYMOLOGY. From the Latin *acuminatus* (tapering to a narrow point) in reference to the leaf apex.

NOTE. Seidenfaden (1978b) provided a full discussion of the taxonomy of this species.

2. **M. aphylla** (King & Pantling) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 71 (1951). Type: India, Sikkim, Teesta (Tista), *Pantling* 455 (holo. CAL, iso. K!).

Microstylis aphylla King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 18, t.22 (1898).

Plant terrestrial or epiphytic, mycotrophic, leafless, 19–22cm tall. *Pseudobulbs* irregularly cylindric, glabrous, 2.5–3 × 0.7–0.8cm. *Stem* arising from apex of pseudobulb, ribbed; basal sheath 2–2.5cm long; stem bracts 2 or 3, distant, lanceolate, acute, c.1.2cm long. *Inflorescence* racemose, laxly few-flowered at base and densely many-flowered at apex; rachis c.5cm long; floral bracts lanceolate, deflexed, 1–2mm long. *Flowers* c.3mm across, uniformly yellowish, flushed with dull purple; pedicel and ovary 2–3mm long. *Sepals* subsimilar, elliptic, subobtuse, 1–1.6mm long; *dorsal sepal* erect, concave, margins revolute, 0.5–0.6mm wide; *lateral sepals* recurved. *Petals* linear, appressed to the lateral sepals, 1–1.5mm long. *Lip* flat, ovate, margins entire, 1–2 × c.0.6mm (at apex); base with 2 broad, obtuse, weakly falcate, erect lobes; apex obtuse. *Column* c.0.6mm long; column wings prominent.

Sikkim (Tista River). Fl. June–July.

GENERAL DISTRIBUTION. NE India (Arunachal Pradesh).
ETYMOLOGY. From the Greek *a-* (without) and *phyllon* (leaf).

3. **M. calophylla** (Rchb. f.) Kuntze in Revis. Gen. Pl.: 673 (1891). Type: Peninsular Malaysia ex Groenewegen (Amsterdam), cult. Mackoy, Veitch & Bull (holo. W! Herb. no. 41044).
Epidendrum variegatum König in Retzius, Observ. Bot. 6: 44 (1791), *nom. illeg.*
Microstylis calophylla Rchb. f. in Gard. Chron. n.s., 12: 718 (1879).
M. wallichii var. *brachycheila* Hook. f., Fl. Brit. India 5(2): 686 (1890). Type: Myanmar (Burma), Moulmein, Parish 198 (holo. K!).
M. scottii Hook. f., *op. cit.* 687 (1890). Type: Myanmar (Burma), Pegu, icon. Scott (holo. CAL).
Malaxis calophylla var. *brachycheila* (Hook. f.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 71 (1951).
Crepidium calophyllum (Rchb. f.) Szlachetko in Fragm. Florist. Geobot. suppl. 3: 125 (1995).

Plant terrestrial, 20–30cm tall. *Stem* pseudobulbous, erect, stout, leafy, c.2cm long. *Leaves* 3 or 4, oblong-lanceolate, oblique, acute, bronze, with green spotting, shortly petiolate, 4–12 × 1.7–4.2cm, margins crenate, cream-coloured; petiole sheathing at base, 1–3.5cm long. *Inflorescence* racemose, laxly to subdensely many-flowered; peduncle ridged, 12–14cm long; rachis 3–11cm long; floral bracts narrow, setaceous, acuminate, lower reflexed, 4–7mm long. *Flowers* 3–5mm long; sepals and petals pale pink-purple to greenish-yellow or cream, lip green-yellow; pedicel and ovary linear, winged, not twisted, 3–4mm long. *Dorsal sepal* oblong, obtuse, 3–4 × 0.5–1mm; *lateral sepals* oblong, curved, obtuse, 3–4 × c.1mm. *Petals* narrowly linear, obtuse, 3.5–4.5 × c.0.25mm. *Lip* 2-auriculate, 4–5 × 2.5–3.5mm; auricles lanceolate, sagittate, acute, overlapping at tips, c.3 × 1.5mm; base 3-lobed with projecting, notched mid-lobe. *Column* stout, c.1mm long.

Sikkim (Tista Valley). 500m. Fl. July.

GENERAL DISTRIBUTION. Myanmar, China, Thailand, Cambodia, Malaysia and Borneo.
ETYMOLOGY. From the Greek *calo-* (beautiful) and *phyllon* (leaf) in reference to the characteristically patterned leaves.

4. **M. josephiana** (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 673 (1891). Type: cult. K from seed sent from Sikkim by Gammie (holo. K, not located); Lectotype (selected here): [icon in] Bot. Mag. 103: t.6325 (1877)!
Microstylis josephiana Rchb. f. in Bot. Mag. 103: t.6325 (1877)

Plant terrestrial, 17–30cm tall; *roots* fasciculate. *Stem* arising from base of pseudobulb, 3–6cm long, leafy. *Pseudobulbs* compressed, filiform, enclosed in sheaths, 3–5cm tall; sheaths broad, acuminate, 1–3cm long. *Leaves* 3–5, oblong-lanceolate to elliptic-ovate, slightly oblique, acute, plicate, petiolate and sheathing at base, margins wavy, purplish-brown above, green beneath, 8–12 × 4–7cm; petiole wide, 2–3cm long. *Inflorescence* racemose, laxly 6- to 12-flowered; peduncle glabrous, deeply ridged, 9–14cm long; rachis ridged, 5–11cm long; floral bracts lanceolate, reflexed, 4–6 × 1.5–2.5mm. *Flowers* 1–1.5cm long; sepals, petals and lip yellow-ochre, shaded with brown or yellow, column with red blotches; pedicel and ovary suberect, linear, ridged, 4–8mm long. *Sepals* subsimilar, broadly ovate, recurved, connate at base, c.1cm long; *dorsal sepal* saccate at the base. *Petals* linear-oblong, acute, recurved, 8–9mm long. *Lip* ventricose, 0.7–1 × 0.7–0.9cm; base weakly saccate, with short, broad, rounded auricles and a 4-chambered nectary; apex bifid. *Column* arms thick, c.2mm long.

Darjeeling (Kurseong, Pankhabari); **Sikkim** (Tista Valley). In tropical valleys; 500–830m. Fl. May.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after Sir Joseph Dalton Hooker (1817–1911) who was Editor of the Botanical

Magazine 'in recognition of his services to orchidology, when exploring for the first time by any botanist, the primeval forests of the Sikkim Himalayas'.

NOTE. The flowers open two or three at a time and are short-lived (King & Pantling, 1898).

5. M. khasiana (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 673 (1891). Type: India, Khasia Mountains, *Lobb* s.n. (holo. K!).

Microstylis khasiana Hook. f., Icon. Pl., ser.3(19) t.1831 (1889); Fl. Brit. India 5(2): 686 (1890).

Crepidium khasianum (Hook. f.) Szlachetko in Fragm. Florist. Geobot. suppl. 3: 127 (1995).

Plant terrestrial, 17–30cm tall; *roots* fasciculate. *Stem* short, leafy, 4–8cm long. *Leaves* 4 or 5, petiolate, ovate-lanceolate, oblique, acute to acuminate, margins undulate-wavy, strongly veined, greenish-grey flushed with purple, 4–9.5 × 1.5–4cm; petiole expanded into sheathing base, 1.5–4cm long. *Inflorescence* racemose, lax below, dense above; peduncle deeply ridged, glabrous, ebracteate, 7–16cm long; rachis 4–5cm long; floral bracts lanceolate, acute, reflexed at base, 1-veined, 4–7 × 1–1.5mm. *Flowers* c.2mm across; sepals and petals purple, lip yellowish-green; pedicel and ovary 3–5mm long. *Sepals* subsimilar, broadly ovate, concave, c.2mm long; *dorsal sepal* subacute; *lateral sepals* obtuse. *Petals* linear, truncate, c.2 × 0.25mm. *Lip* broad, concave, with a central constriction, 2.5–3 × c.2mm (when spread); base 2-lobed, auriculate, falcate, acute, apices converging or overlapping; apex broad to transversely oblong, margin erose, incurved. *Column* c.1mm long.

Darjeeling (Rishap); **Sikkim** (unlocalised *Pantling* specimen). 1000–3000m. Fl. July–August.

GENERAL DISTRIBUTION. NE India, Thailand, China (Yunnan).

ETYMOLOGY. From Khasia, where the type specimen was found.

NOTE. *M. khasiana* can be recognised by the characteristic constriction in the centre of the lip.

6. M. maximowicziana (King & Pantling) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 72 (1951). Type: India, Darjeeling, Mungpoo (Mongpu) Cinchona Plantation, *Pantling* 226 (holo. CAL, iso. K!).

Microstylis maximowicziana King & Pantling in J. Asiat. Soc. Bengal 64(3): 329 (1896).

Crepidium maximowiczianum (King & Pantling) Szlachetko in Fragm. Florist. Geobot. suppl. 3: 129 (1995).

Plant terrestrial, c.50cm tall; *roots* fasciculate. *Stem* suberect, rhizomatous, enclosed in clasping sheaths, 14–16cm long; sheaths 3–4cm long. *Leaves* 5, petiolate, elliptic to ovate, slightly oblique, acute, strongly 7-veined, 12–16 × 5–5.5cm; petiole sheathing at base, 3–4cm long. *Inflorescence* racemose, cylindric, densely many-flowered; peduncle ridged, ebracteate, c.14cm long; rachis ridged, pubescent, c.12cm long; floral bracts linear-lanceolate, acute, 4–6 × 0.5–1mm. *Flowers* c.1.5mm long, uniformly green; pedicel and ovary with undulate ridges, 4–5mm long. *Sepals* subsimilar, oblong, obtuse, margins recurved, 1.5–2mm long; *lateral sepals* slightly wider than the dorsal sepal. *Petals* linear, obtuse, reflexed, c.1.5mm long. *Lip* concave, hood-shaped, c.1.5mm long; base 2-auriculate, weakly falcate, obtuse; apex contracted, crenulate, with 2 minute teeth. *Column* 1–1.5mm long.

Darjeeling (Mongpu Cinchona Plantation). 830m. Fl. July.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named after Carl Johann Maximowicz (1827–1891), a Russian botanist and explorer who travelled in E Asia between 1853 and 1857.

7. M. purpurea (Lindl.) Kuntze, Revis. Gen. Pl. 2: 673 (1891). Type: Sri Lanka (Ceylon), *Macrae* s.n. (holo. K, not located, probably lost).

Microstylis purpurea Lindl., Gen. Sp. Orchid. Pl.: 20 (1830).

M. wallichii var. *biloba* (Lindl.) Hook. f., Fl. Brit. India 5(2): 686 (1888).

M. liparioides Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 62 (1919). Type: China, Yunnan, *Henry* 13131 (holo. B).

Malaxis liparioides (Schltr.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 72 (1951).
Crepidium purpureum (Lindl.) Szlachetko in Fragm. Florist. Geobot. suppl. 3: 131 (1995).

Plant terrestrial, 14–30cm tall; *roots* fasciculate, slender, c.1mm wide. *Stem* glabrous, sheathed at base. *Leaves* 3 or 4, thinly membranous, elliptic-oblong, acute to acuminate, narrowed to sheathing base, petiolate, 9–14 × 3.5–5.5cm; petiole 3–4cm long. *Inflorescence* racemose, laxly many-flowered; peduncle ribbed, 13–28cm long; rachis glabrous, 7–12cm long; floral bracts linear-lanceolate, subacute, reflexed, 6–7 × c.1.5mm. *Flowers* 5–8mm long, uniformly yellowish-green, yellow tinged with red-purple or pink-purple; pedicel and ovary linear, 6-ridged, 0.5–1cm long. *Dorsal sepal* ovate-lanceolate, margins recurved, 5–6 × 2–2.5mm; *lateral sepals* broadly ovate-elliptic, subacute, 4–5 × 2.5–4mm. *Petals* linear, obtuse, margins recurved, 4–5.5 × 0.8–1mm. *Lip* slightly convex, narrowly ovate-sagittate, 6–7 × 4–5mm (when flattened); base divided into 2 falcate-triangular auricles, c.2.5mm long; apex bent forward, forming an obovate-oblong or subquadrate terminal lobe, divided into 2 parallel oblong lobules; disc base with depression. *Column* fleshy, c.1.5mm long. *Fruit* fusiform, c.1.5cm long.

Darjeeling (unlocalised *Cowan* specimen); **Sikkim** (unlocalised *Pantling* specimen). 700–800m. Fl. June–August.

GENERAL DISTRIBUTION. Sri Lanka, NE India, China, Indo-China, Taiwan and the Philippines.
ETYMOLOGY. From the Latin *purpureus* (purple) in reference to the flower colour.
NOTES. Hooker (1890) described var. *biloba* of *M. wallichii* and this treatment was supported by King & Pantling (1898) who had examined extensive living material. Seidenfaden (1978b) reviewed the considerable taxonomic confusion over this variety and suggested that var. *biloba* was a synonym of *M. purpurea* (Lindl.) Kuntze, a treatment which Deva & Naithani (1986), Su (1990) and Seidenfaden (1992) have since followed.

It is difficult to be certain of the correct treatment of this taxon (which is close to *M. acuminata*) since we have not been able to locate the type material of *M. purpurea* (a Macrae collection from Sri Lanka). The main distinguishing feature of the species is that the sides of the lip have an indentation separating the 2-lobed apex from the low lateral lobes. Further collections are required to resolve the problem.

8. M. saprophyta (King & Pantling) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 75 (1951). Type: India, Sikkim, Choongthang (Chunthang), *Pantling* 394 (holo. CAL, iso. K! W!).
Microstylis saprophyta King & Pantling in J. Asiat. Soc. Bengal 65(2): 118 (1896).

Plant terrestrial or epiphytic, mycotrophic, leafless, c.10cm tall. *Stem* pseudobulbous at base, ribbed, 6–9cm tall, with 2 or 3 crowded, tubular, sheaths above the globose pseudobulb; sheaths subacute, c.2cm long. *Inflorescence* racemose, lax below, dense above; rachis c.3cm long; floral bracts lanceolate, subacute, 2–3mm long. *Flowers* 2.5–3mm across (when open), uniformly greenish; pedicel and ovary 1–2mm long. *Sepals* subsimilar, ovate, obtuse, 1.4–1.6mm long; *dorsal sepal* reflexed and appressed to the ovary; *lateral sepals* revolute. *Petals* linear, revolute, c.1.5mm long. *Lip* orbicular-reniform to orbicular-triangular, entire, with a crescent-shaped, convex fold in the middle of the upper surface, 1.5–2.5mm long; basal auricles erect, short, broad, subacute, membranous; apex acute. *Column* c.0.8mm long, wings prominent.

Sikkim (Chunthang). Fl. July.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *saprophyticus* (saprophytic), a mode of plant nutrition now known as mycotrophic.
NOTE. *M. saprophyta* is closely allied to *M. aphylla*; the former is a smaller plant with a globose pseudobulb, and a rounded lip with a convex fold on the upper surface (King & Pantling, 1898).

Section **Gerontogeae** Ridley in J. Linn. Soc., Bot. 24: 316, 333 (1888).
Lectotype (selected here): M. *muscifera* (Lindl.) Kuntze.

We have reinstated this section to include those species which lack basal auricles and have a simple, weakly cordate to triangular lip but that do not fit into the sections Glossochilus or *Gastroglottis*. Section Glossochilus includes species with a simple oblong lip (type: *Microstylis chamaeorchis* Schltr.) and section *Gastroglottis* includes species with a 3-lobed lip apex (type: *Malaxis ophrydis* (König) Ormerod).

We agree with Seidenfaden (1978b) that a new monograph of this large and difficult genus is needed.

9. M. cylindrostachya (Lindl.) Kuntze, Revis. Gen. Pl.: 673 (1891). Type: Nepal, Sheopore, coll. *Wallich* Wall. Cat. 1934 (holo. K-LINDL!, iso. K-W! K!).

Dienia cylindrostachya Lindl. in Wall. Cat.: 1934 (1829) nom. nud.; Gen. Sp. Orchid. Pl.: 22 (1830).

Microstylis cylindrostachya (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 207 (1861).

Plant terrestrial, 20–35cm tall; roots fasciculate. *Pseudobulbs* conical, c.1 × 1cm. *Stem* arising from base of pseudobulb, sheathed, 3–10cm long; sheaths 2 or 3, clasping, 2–3cm long. *Leaf* 1, elliptic or orbicular to subspathulate, obtuse, long-petiolate, finely, reticulately veined, 4–9 × 3–4.5cm; petiole tubular, sheathing stem, 2–5cm long. *Inflorescence* racemose, cylindric, densely many-flowered; peduncle ridged, 5–10cm long; rachis ridged, (2.5–)5–14cm long; floral bracts lanceolate, acute, 2–2.5mm long. *Flowers* c.2mm long, uniformly yellowish-green; pedicel and ovary linear, not twisted, 1.5–2mm long. *Sepals* subsimilar, ovate, acuminate, 2–3 × 0.5–1.4mm. *Petals* linear-lanceolate, acute, 1–1.9 × 0.4–0.5mm. *Lip* fleshy, broadly ovate, 1.5–2 × 1–2mm, margins thickened, with a raised central ridge; base weakly saccate, margins denticulate; apex apiculate to mucronate. *Column* stout, c.0.25mm tall.

Bhutan: C – Thimphu district (Choidi Ponkey to Sage-La, Telecommunications dish on mountain E of Thimphu, above Yanchengphug); N – Upper Mo Chu district (Rodochu); **Sikkim** (Lachen Valley); **Chumbi** (Rinchengang, Yatung). On open grassy places cleared from *Picea* woodland, growing under shade in wet corner of *Pinus wallichiana* forest; 3000–4000m. Fl. July–August.

GENERAL DISTRIBUTION. India, Nepal and China (Xizang).

ETYMOLOGY. From the Latin *cylindrus* (cylinder) and the Greek *stachys* (a spike) in reference to the inflorescence.

NOTE. M. *cylindrostachya* is closely related to M. *muscifera* but has a single leaf and a densely cylindric, many-flowered inflorescence.

10. M. muscifera (Lindl.) Kuntze, Revis. Gen. Pl. 2: 673 (1891). Type: Nepal, Gossainthan, *Wallich's collectors* Wall. Cat. 1935 (holo. K!, iso. K-W!).

Dienia muscifera Lindl. in Wall. Cat.: 1935 (1829) nom. nud.; Gen. Sp. Orchid. Pl.: 23 (1830).

Microstylis muscifera (Lindl.) Ridley in Journ. Linn. Soc. 24: 333 (1888).

Plant terrestrial, (8–)12–30cm tall; *rhizome* short. *Pseudobulbs* ovoid, sheathed, 1–1.5cm tall. *Stem* arising from apex of pseudobulb, sheathed, leafy, 3–8cm long; sheath 2–2.5cm long. *Leaves* 2, ovate-oblong to lanceolate-oblong, obtuse to subacute, petiolate to subsessile, finely reticulately veined, (1.5–)2–10 × 0.6–6cm; petiole sheathing at base, 0.5–2cm long. *Inflorescence* racemose, subdensely many-flowered; peduncle ridged, 9–14 × 0.1–0.3cm; rachis 4–16cm long; floral bracts lanceolate, acute, 2–4 × 0.5–1mm. *Flowers* erect, c.2mm long, uniformly yellowish-green to pale green; pedicel and ovary twisted, linear, 1.5–2mm long. *Sepals* subequal, broadly oblong-lanceolate, subacute, 1-veined, 1–2.5 × 1–1.3mm. *Petals* broadly linear-lanceolate to linear, acute to subacute, 1-veined, 1–2.5 × 0.2–0.3mm. *Lip* superior, fleshy, broadly ovate, 1.5–2.1 × 1–1.5mm; base weakly saccate, with obscure, thickened, incurved, lateral lobes (glandular within); apex apiculate to mucronate, prominently 3-ridged inside. *Column* fleshy, with 2 small, spreading 3-lobed wings, 0.5–0.8mm long. *Fruit* erect, ovoid, 4–5 × 2–3mm. **Fig. 50.**

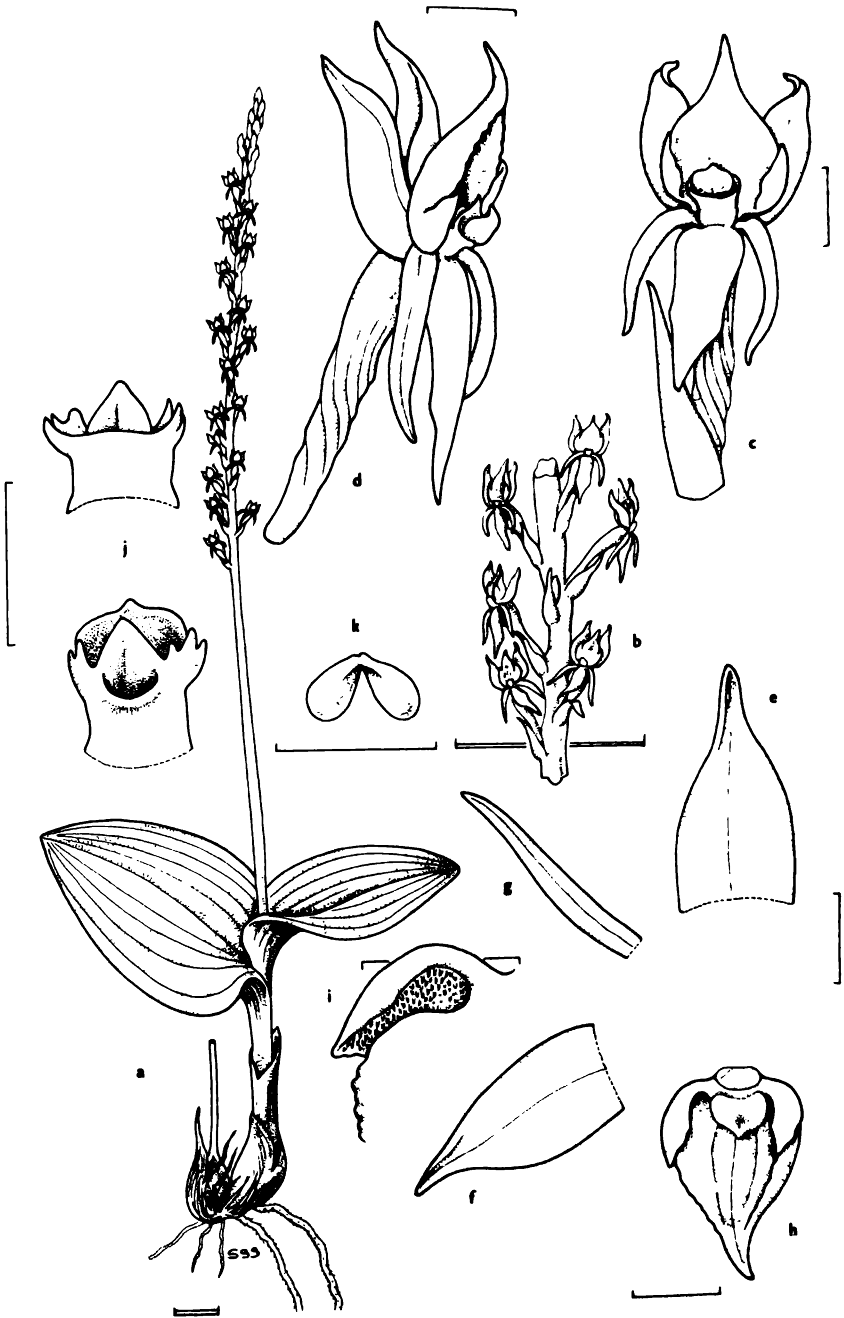


Fig. 50. **Malaxis muscifera**: a, habit; b, inflorescence; c, flower and ovary; d, flower and ovary, (side view); e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, lip base (detail); j, column apex (two views); k, pollinia. Drawn by Susanna Stuart-Smith from *Wood* 6472 (E).

Bhutan: **C** – Thimphu (Chenkaphug, W of Hongtso, W of Pajoding Monastery, above Thimphu Hospital, Tzatogang), Tongsa (Yuto La) and Bumthang (Lami Gompa) districts; **N** – Upper Mo Chu (Lingshi Dzong, near Tatsi Markha), Upper Pho Chu (Lhedi), Upper Bumthang Chu (Chamka, Pangotang) and Upper Kulong Chu (Me La) districts; **Darjeeling** (Kalipokhri, Manibhanjan to Sandakphu, Tiger Hill Mountain, Tonglu); **Sikkim** (Damthang to Tendong (F.E.H.2), Lachen, Lachung Valley, Singalila Range, W of Thanggu); **Chumbi** (Trakarpo to Phari Dzong, Yatung). On shady bank by road in disturbed oak/spruce forest, shady mossy bank on *Abies*/*Juniperus*/*Rhododendron* forest, on damp, shaded rocks near streams in humid, mixed *Tsuga*/*Abies* woodland, on grassy slopes; 2600–4300m. Fl. June–August; Fr. September–October.

GENERAL DISTRIBUTION. India, Nepal.

ETYMOLOGY. From the Latin *muscifer* (fly-bearing) from a suggested resemblance of the flowers to flies.

Section **Gastroglottis** (Bl.) Seidenfaden in Dansk Bot. Ark. 33(1): 43 (1978).

11. **M. ophrydis** (König) Ormerod in Seidenfaden, Descrip. Epidend. König 1791: 18 (1995). Type: Thailand, (presumably Phuket area), *König* s.n. (holo. LIV!, iso. K!).

Epidendrum ophrydis König in Retzius, Observ. Bot. 6: 46 (1791).

Malaxis latifolia J.E. Smith in Rees, Cycl.:22 (1822). Type: Nepal, Narainhetty, *Buchanan-Hamilton* s.n. (holo. LINN! Herb. no. 1396.3.1).

Dienia congesta Lindl. in Bot. Reg. 10: sub t.825 (1824). Type: Nepal, coll. *Wallich* Wall. Cat. 1936 (holo. K-LINDL!, iso. K-W!).

Neottia plantaginea D. Don, Prodr. Fl. Nepal: 27 (1825). Type: Nepal, *Wallich* s.n. (holo. BM!).

Malaxis parvissima S.Y. Hu in Chung Chi J. 13(2): 22, t.10 (1976). Type: China, Hong Kong, S.Y. Hu 12453 (holo. K!).

M. *vietnamensis* Ban & Huyen, Danh. Luc, Thuc Vat Tay Nguyen: 202 (1983). Type from Vietnam.

M. *latifolia* var. *nana* S.S. Ying in Mem. Coll. Agric. Natl. Taiwan Univ. 25(2): 101 (1985). Type from Taiwan.

M. *shuicai* S.S. Ying in J. Jap. Bot. 62(3): 70, t.1 (1987). Type from Taiwan.

Plant terrestrial. *Pseudobulbs* enclosed by scarious sheaths, 1–2cm tall. *Leaves* 4 or 5, membranous, elliptic to ovate-elliptic, shortly acuminate, petiolate, 7–15 × 3–6cm; petiole sheathing at base, 4–7cm long. *Inflorescence* racemose, erect, slender, subdensely to densely many-flowered; peduncle ridged, 16–23cm long; rachis ridged, 5.5–7cm long; floral bracts linear, acuminate, 4–5mm long. *Flowers* c.2mm long, uniformly red, purplish or yellow to yellowish-green; pedicel and ovary ridged, 2–4mm long. *Sepals* subsimilar, reflexed; *dorsal sepal* oblong or elliptic, obtuse, c.3mm long; *lateral sepals* oblique, ovate, obtuse, c.3mm long. *Petals* reflexed, linear-oblong, c.3mm long. *Lip* fleshy, subquadrate, c.3mm; base extending to 2 triangular, obtuse, dentiform, lateral lobes and a central oblong-triangular to oblong apex; disc boat-shaped, excavated. *Column* stout. *Fruit* erect, c.9 × 5mm.

Bhutan: **S** – Sarbhang district (Sarbhang–Chirang road, 8km from Sarbhang); **C** – Punakha (Samtengang) and Mongar (Kuru Chu N of Lhuntse) districts; **Darjeeling** (Dalkajhar, 12km S of Kalimpong); **Sikkim** (Gangtok to Temi; unlocalised specimens). On shaded bank under shrubs in steep hot jungle, in monsoon forest; 800–2850m. Fl. May–August; Fr. October.

GENERAL DISTRIBUTION. Sri Lanka, India, China, SE Asia, the Ryukyu Islands, the Philippines, Malaysia, Indonesia, New Guinea and Australia.

ETYMOLOGY. Implying a resemblance to the orchid genus *Ophrys* which was once used in a much wider sense than it now is.

NOTES. This species is better known as M. *latifolia* J.E. Smith, but since *Epidendrum ophrydis* König predates J.E. Smith's name, the rule of priority must apply. Clements & Jones (1996) proposed separating *M. ophrydis* (as *Crepidium ophrydis*) and *M. latifolia* (as *Dienia latifolia*). They stated that the type material contained two different species which permitted the preservation of the epithet '*latifolia*'. The type sheet bears two specimens (one flowering and one fruiting), but since this is a widespread and variable species we do not feel that their view is justified and here follow Seidenfaden (1995b). An extended synonymy can be found in Seidenfaden (1978b, 1997).

Doubtfully recorded species.

M. cordifolia (Rolfe) Ames & C. Schweinfurth in Ames, Orchidaceae 6: 73 (1920), *in adnot*. Type: NE Celebes (Sulawesi), Lokon, Goenoeng Klabat, Minahassa, *Koorders* 29539 (holo. K!).
Microstylis cordifolia Rolfe in Bull. Misc. Inform. Kew 1899: 127 (1899).

NOTE. Bose & Bhattacharjee (1980) reported this Indonesian species from Sikkim. It has never been reported from our area before and we have seen no herbarium material from the region. We suspect either that the record was based on a misidentification or that *Liparis cordifolia* Hook. f. was intended.

50. **Oberonia** Lindl.

Plants epiphytic or occasionally terrestrial, small to medium in size, erect to pendent; *roots* basal, fibrous. *Stems* usually clustered, leafy, short to elongate. *Leaves* fleshy, distichous, forming a fan or distributed along the stem, bilaterally compressed to terete, often jointed to a compressed leaf base. *Inflorescence* terminal, racemose or spicate, densely many-flowered, cylindric. *Flowers* non-resupinate, flat, minute to small, spiral to verticillate. *Sepals* and *petals* spreading, free, subsimilar; petals smaller and narrower. *Lip* sessile, deflexed, entire or variously lobed, auriculate at base, ecallose, often erose. *Column* very short, fleshy, usually enclosed by basal auricles of the lip; pollinia 4, pyriform, waxy.

The genus *Oberonia* was established in 1830 by John Lindley in his *Genera and Species of Orchidaceous Plants*. Later, in his *Sertum Orchidaceum* (1838), he commented upon these fascinating little plants that 'if the Brahmins had been botanists one might have fancied they took their doctrine of metempsychosis from these productions; in the genera *Oberonia* ... Pythagoras would have found a living evidence of animals transmuted into plants.' The genus comprises over 100 species in tropical Asia, extending to the Pacific Islands, Australia and with a single species in Madagascar and tropical Africa.

Sectional treatments have been attempted by Lindley (1859), Hooker (1890), Schlechter (1911) and Seidenfaden (1968) but none of these is entirely satisfactory. The Indian species have been monographed by Ansari & Balakrishnan (1990) who essentially followed the treatment of Seidenfaden (1968). A thorough monograph of the genus is required.

TYPE. *Oberonia iridifolia* (Roxb.) Lindl. *nom. illeg.*; *Oberonia ensiformis* (J.E. Smith) Lindl. *nom. cons.*; basionym: *Malaxis ensiformis* J.E. Smith.
ETYMOLOGY. Named after Oberon, the mythical king of the Fairies.

Key to species

1. Leaves jointed at base 2
+ Leaves not jointed at base 9

2. Inflorescence stout, flowers embedded in the fleshy rachis .... **7. O. pachyrachis**
+ Inflorescence not stout, flowers pedicellate 3

3. Plants with well-developed stems; leaves grass-like, arranged along stem ...... **2. O. caulescens**
+ Plants stemless; leaves ensiform, overlapping-flabellate at base 4

4. Lip narrowed at middle 5
+ Lip not narrowed at middle 6

5. Lip lacking cushion-like calluses under the lateral lobes .... **1. O. acaulis**
+ Lip with two cushion-like calluses under the lateral lobes .... **3. O. ensiformis**

6. Lateral lobes of lip lacerate; apex obscurely 2-lobed 7
+ Lateral lobes of lip entire; apex deeply 2-lobed 8

7. Peduncle not 2-winged; lateral lobes of lip shallowly lacerate; plants less than 12cm tall **5. O. lobulata**
+ Peduncle 2-winged; lateral lobes of lip deeply lacerate; plants more than 20cm tall **6. O. mucronata**

8. Lobules of lip mid-lobe short, less than a quarter as long as the lip .... **4. O. falconeri**
+ Lobules of lip mid-lobe long, half as long as the lip .... **8. O. pyrulifera**

9. Plants with well-developed stems 10
+ Plants stemless 12

10. Lip obscurely 3-lobed; apex truncate to obscurely 2-lobed .... **9. O. angustifolia**
+ Lip clearly 3-lobed; apex clearly 2-lobed 11

11. Lateral lobes of lip short; mid-lobe not broadening from base .... **12. O. falcata**
+ Lateral lobes of lip long; mid-lobe broadening from base .... **14. O. obcordata**

12. Mid-lobe of lip 2-lobed 13
+ Mid-lobe of lip not 2-lobed 14

13. Lateral lobes of lip orbicular; peduncle bracts lanceolate .... **17. O. recurva**
+ Lateral lobes of lip filiform; peduncle bracts filiform .... **18. O. rufilabris**

14. Lip 3-lobed 15
+ Lip undivided 17

15. Leaves more than 5mm wide; inflorescence truncate .... **10. O. brachystachys**
+ Leaves less than 5mm wide; inflorescence not truncate 16

16. Lateral lobes of lip narrow, entire, recurved; flowers green-yellow .... **11. O. emarginata**
+ Lateral lobes of lip broad, spreading, irregular; flowers reddish .... **13. O. jenkinsiana**

17. Apex of lip entire .... **15. O. pachyphylla**
+ Apex of lip dentate .... **16. O. prainiana**

Subgenus **Oberonia**

[*Apotemnophyllum* Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 178 (1911)]

1. **O. acaulis** Griff., Itin. Pl. Khasyah Mts.: 76 (1848). Type: India, Khasia, Churra, *Griffith* s.n. (holo. K-LINDL!).

Oberonia sikkimensis Lindl., Fol. Orchid. Oberonia 8: 4, no.22 (1859). Type: India, Sikkim, *Hooker* 114 (holo. K-LINDL!).

O. myriantha Lindl., op. cit. no.23 (1859). Types: India, Khasia, *Griffith* s.n. (syn. K-LINDL!); *Hooker & Thomson* 113 (syn. K-LINDL!, isosyn. L!).

Malaxis sikkimensis (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 212 (1861).
M. myriantha (Lindl.) Rchb. f., *loc. cit.* (1861).
Iridorchis myriantha (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).

Plant 25–40cm tall; *roots* fasciculate. *Stem* short. *Leaves* 3–5, linear-ensiform, falcate, acuminate, unequal, 6–20 × 0.5–1cm. *Inflorescence* verticillate, long, slender, decurved, densely many-flowered; peduncle terete, bracteate, 5–9cm long; peduncle bracts linear, distant, 3–4mm long; rachis 11–28cm long; floral bracts lanceolate, acuminate, erose-fimbriate, 1.5–2.5mm long. *Flowers* c.1.5mm across, uniformly brown; pedicel and ovary 1–1.5mm long. *Sepals* similar, ovate, entire, reflexed, 0.6–1mm. *Petals* oblong, entire, truncate, reflexed, c.1mm long. *Lip* 3-lobed, warty, 1.5–2 × 1.5mm (when spread); lateral lobes broadly oblong, crenulate, obtuse; mid-lobe large, divided into 2 broadly oblong, obtuse lobules, separated by a triangular to acute sinus. *Column* simple, c.0.25mm long. *Fruit* erect to pendent, ridged, 4–5 × 2–3mm.

Bhutan: S – Gaylegphug district (Sham Khara (M.F.B.)); C – Punakha (between Bhotokha and Rimchu) and Tashigang (near Karchang (M.F.B.)) districts; **Darjeeling** (Sureil, Takdah); **Sikkim** (Chongpung, Jaldhaka River Valley, Nanga, Rathang Chhu, below Yoksam). 1000–1660m.
Fl. October–December; Fr. May.

GENERAL DISTRIBUTION. N India, Thailand, Myanmar, China (Yunnan) and Vietnam.
ETYMOLOGY. From the Greek *a*- (without) and the Latin *caulis* (stem).
NOTES. Seidenfaden (1978b) argued that *O. myriantha* and *O. acaulis* were indistinguishable and included *O. myriantha* within the synonymy of *O. acaulis*. Ansari & Balakrishnan (1990) treated them as distinct species on the basis of differences in the column structure. Seidenfaden (1992) considered that further study of all available herbarium material should be undertaken before the position could be clarified and we agree with this. The Griffith type of *O. acaulis* cannot be found and having examined the herbarium material available we are unable to confirm the differences in column structure outlined by Ansari & Balakrishnan and follow Seidenfanden in treating them as conspecific.

O. acaulis is related to *O. ensiformis* but the inflorescence is longer than the leaves and the lip lacks the 2 lateral calluses.

2. O. caulescens Lindl., Fol. Orchid. Oberonia 2: 7, no.39 (1859). Types: Nepal, without precise locality, Wall. Cat. 1950 (syn. K-LINDL!, isosyn. K-W!); India, Khasia, *Hooker* & *Thomson* 116 (syn. K-LINDL!).
Malaxis caulescens (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 215 (1861).
Iridorchis caulescens (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).
Oberonia longilabris King & Pantling in J. Asiat. Soc. Bengal 64(3): 330 (1896). Type: India, Sikkim, Songchongloo, *Pantling* 227 (holo. CAL).
O. auriculata King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 13, t.16A (1898). Type: India, Darjeeling, Sureil and Rungbee, *Pantling* 166 (holo. CAL!).
O. yunnanensis Rolfe in J. Linn. Soc., Bot. 36: 6 (1903). Type: China, Yunnan, Manme, *Henry* 9152 (holo. K!).
O. bilobatolabella Hayata, Icon. Pl. Formos. 4: 24 (1914). Type from Taiwan.
O. pterorachis C.L. Tso in Sunyatsenia 1: 135 (1933). Type: China, Kwangtung, *S.P. Ko* 51333 (holo. SYS).

Plant 8–21cm tall; *roots* fasciculate. *Stems* winged, 2–6cm long. *Leaves* 4 or 5, linear-ensiform, acute to acuminate, slightly fleshy, sessile, jointed, 2.5–4 × 0.2–0.4cm. *Inflorescence* erect, subdense, verticillate towards base; peduncle terete, short, bracteate, 2–3cm long; peduncle bracts widely spaced, lanceolate, acute to acuminate, membranous, 1.5–2mm long; rachis slender, winged, 3–12cm long; floral bracts lanceolate, apex aristate, ovate, 0.8–1mm long. *Flowers* 2–3mm long, uniformly reddish-brown to yellow; pedicel and ovary 1–1.5mm long. *Sepals* similar, spreading, ovate, subacute, entire, c.1 × 0.5mm. *Petals* spreading, lanceolate, acute, entire, c.1mm long. *Lip* 3-lobed, slender, 1–2mm long; lateral lobes triangular-falcate, apices recurved; mid-lobe deeply divided; lobules caudate-acuminate,

± parallel, 0.3–0.5mm long, separated by a deep, narrow, mucronate sinus. *Column* winged, 0.1–0.2mm long. *Fruit* c.1.5 × 1mm.

Bhutan: S – Chukka district (5km N of Jumudag); C – Punakha (Bhotokha to Rimchu), Punakha/Tongsa (between Ritang and Rukubji) and Tongsa (near Rukubji, Tashiling to Tongsa) districts; **Darjeeling** (Rangli Rangliot, Sureil); **Sikkim** (Chunthang, Nanga). On *Quercus lamellosa*; 1660–2600m. Fl. March–September; Fr. April.

GENERAL DISTRIBUTION. India and China (Yunnan).

ETYMOLOGY. From the Latin *caulis* (stem) and the suffix *-escens* (not fully achieved, '-ish').

NOTES. The type of *O. auriculata* is at CAL, but was not been seen by Seidenfaden (1968). The protologue and drawings have been compared with *O. caulescens* from which we are unable to distinguish it, so we follow Ansari & Balakrishnan (1990) and treat it in synonymy. The mid-lobe lobules are variable in *O. caulescens*, as are the petals, which were distinguishing features cited by King & Pantling (1898).

Ansari & Balakrishnan (1990) stated that *Pantling* 454 at CAL had been determined as *O. falcata*, but we have examined a duplicate at E which has jointed leaves. We have, therefore, included this specimen under *O. caulescens*.

3. O. **ensiformis** (J.E. Smith) Lindl., Fol. Orchid. Oberonia 8: 4, no.21 (1859). Type: Nepal, Narainhetty, *Buchanan-Hamilton* 1806 (holo. LINN! Herb. no. 1396.11.1, iso. BM!).

Malaxis ensiformis J.E. Smith in Rees, Cycl. 22: no.14 (1812).

Oberonia trilobata Griff., Not. Pl. Asiat. 3: 273 (1851). Type: India, Khasia, *Griffith* 129 (holo. K-LINDL!).

Iridorchis ensiformis (J.E. Smith) Kuntze, Revis. Gen. Pl. 2: 669 (1891).

Plant 20–35cm tall; *roots* fasciculate. *Stem* short. *Leaves* 4 or 5, linear-ensiform, falcate, acute, overlapping, flabellate at base, 5.5–30 × 0.7–1.5cm. *Inflorescence* erect, subtruncate, densely many-
224 flowered; peduncle bracteate, 7–10cm tall; peduncle bracts distant, lanceolate, acute, 2–4cm long; rachis thick, fleshy, 6.5–14cm long; floral bracts convolute, ovate-orbicular, acute, apex erose, 2–3.5 × 1–1.5mm. *Flowers* 2–3mm long, uniformly pale brown; pedicel and ovary c.1mm long. *Sepals* subsimilar, broadly ovate, subacute, entire, reflexed, 1–1.5mm long. *Petals* ovate, subacute, pubescent, margins entire, ciliate, 1–1.5mm long. *Lip* 3-lobed, setose, 2–2.5 × 1–1.5mm; lateral lobes rounded, entire; mid-lobe subquadrate, slightly concave, apex reniform, with lobules separated by an apical sinus; calluses 2, lateral at base of lateral lobes. *Column* short, simple. *Fruit* ridged, c.4 × 2mm.

Duars (Kumai); **Darjeeling** (unlocalised *Griffith* specimen). 666m. Fl. October.

GENERAL DISTRIBUTION. India, Nepal, Thailand, Myanmar, China and Indo-China.

ETYMOLOGY. From the Latin *ensiformis* (sword-like).

NOTE. *O. ensiformis* is related to *O. iridifolia* but differs in that the lip margins are entire and not deeply fringed or erose, and there are 2 calluses at the base of the lateral lobes.

4. O. **falconeri** Hook. f., Icon. Pl. ser.3(18): t.1780 (1888); Fl. Brit. India 5(2): 678 (1890). Types: India, Kumaon, *Falconer* 1008 (syn. K!); Nepal, Sheopore, coll. *Wallich* Wall. Cat. 1948.1 (syn. K!, isosyn. K-W!); India, Dehra Dun, Wall. Cat. 1948.3 (syn. K!, isosyn. K-W!); India, Behar, *Hooker* 120 (syn. K-LINDL!); India, Chota Nagpore, *Clarke* 21457 (syn. K!); India, Concan, *Law* s.n. (syn. K!).

Iridorchis falconeri (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).

Oberonia siamensis Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 2: 84 (1906). Type from Thailand.

Plant 7–12cm tall; *roots* fasciculate. *Leaves* 4 or 5, overlapping at base, ensiform, weakly falcate, acute, fleshy, sessile, 2–6.5 × 0.6–1.2cm. *Inflorescence* subdensely many-flowered; peduncle covered with scarious bracts, 2–3.5cm long; peduncle bracts lanceolate, acute to acuminate, 4–5 × 0.5–1mm; rachis winged, 3–5.5mm long; floral bracts scarious, lanceolate, acute to acuminate, 1-veined, 2–3mm long. *Flowers* c.1mm long, uniformly yellow-green to pale brown; pedicel and ovary 1–1.5mm long. *Sepals* similar, oblong-elliptic, obtuse, 1-veined, 0.6–1mm long. *Petals* ovate, obtuse, c.1mm long. *Lip* 3-lobed, broadly oblong, 1–1.5mm long; base with 2 broadly oblong, notched lateral lobes; mid-lobe divided into 2 short, broadly incurved, obtuse, lobules, separated by a broad sinus; surface verrucose to glandulose. *Column* short, simple. *Fruit* ridged, 4–5 × 1.5–2mm.

Sikkim (unlocalised *Henderson* specimen). Fl. January.

GENERAL DISTRIBUTION. India, Nepal, China, Thailand, Laos, Vietnam and Malaysia.
ETYMOLOGY. Named after Hugh Falconer (1808–1865), Scottish botanist and Superintendent of the Saharanpur Botanic Garden between 1832 and 1842.

5. **O. lobulata** King & Pantling in J. Asiat. Soc. Bengal 64(3): 331 (1896). Type: India, Sikkim, *Pantling* 199 (holo. CAL!).

Plant erect to pendent. *Stems* short. *Leaves* 4, large, oblong, subacute, slightly falcate, 2–7.5 × 0.6–1.5cm. *Inflorescence* decurved-pendent, lax; peduncle ebracteate, winged, c.4cm long; rachis slender, subterete; floral bracts sheathing the sessile ovary, oblong, apex obtuse, erose, c.1.5 × 0.75mm. *Flowers* minute, distant, uniformly green; pedicel and ovary c.0.75mm long. *Sepals* similar, ovate, acute, entire, reflexed, c.1 × 0.75mm. *Petals* similar to sepals, narrower, c.0.75 × 0.25mm. *Lip* subquadrate to broadly triangular, narrowed towards apex, 3-lobed, c.1 × 1mm; base broad, truncate; margins dentate-lobulate; apex with a broad, shallow sinus. *Column* c.0.41mm long.

Sikkim (Valley of Tista River). In tropical valleys; 330m. Fl. October.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin lobulus (lobed) in reference to the shape of the lip base.
NOTE. Seidenfaden (1968) doubted whether this species, which has only been collected once, differed from the related *O. gammiei* but treated them separately for want of adequate material.

6. **O. mucronata** (D. Don) Ormerod & Seidenfaden in Seidenfaden, Contrib. Orch. Flora Thailand XIII: 20 (1997). Type: Nepal, *Buchanan-Hamilton* s.n. (holo. BM!).
Stelis mucronata D. Don, Prodr. Fl. Nepal: 32 (1825).
Cymbidium iridifolium Roxb., Hort. Bengal.: 63 (1814) *nom. nud.*; Fl. Ind. ed. 1832, 2(3): 458 (1832). Type: Bangladesh, Chittagong, [icon. of] '*Cymbidium iridifolium*' *Roxburgh* 2340 (holo. CAL, iso. K!).
Oberonia iridifolia Lindl., Gen. Sp. Orchid. Pl.: 15 (1830) *nom. superfl. illeg.*
O. denticulata Wight, Icon. Pl. Ind. Orient. 5: 1625 (1852). Type: India, Iyamally Hills, near Coimbatore, *Wight* 2939 (holo. K!).
Malaxis iridifolia (Roxb.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 208 (1861).
M. denticulata (Wight) Rchb. f., loc. cit. (1861).
Oberonia iridifolia var. *denticulata* (Wight) Hook. f., Fl. Brit. India 5(2): 676 (1890).
Iridorchis iridifolia (Roxb.) Kuntze, Revis. Gen. Pl. 2: 609 (1891).
Oberonia denticulata subsp. *iridifolia* (Roxb.) Panigrahi & Dubey in Proc. 8th Ann. Conf. Orissa Bot. Soc.: 2 (1983).
O. denticulata var. *iridifolia* (Roxb.) S. Misra in J. Orchid Soc. India 3(1–2): 69 (1989).
O. smisrae Panigrahi, Fl. Bilaspur Dist. 2: 591 (1999), **syn. nov.**

Plant 20–30cm tall; roots fasciculate. *Stem* very short. *Leaves* 4–6, broadly ensiform, acute to mucronate, overlapping at base, fleshy, the lower ones smaller, 3.5–26 × 0.8–1.4cm. *Inflorescence* decurved, densely many-flowered; peduncle widely winged, ebracteate, 8–11cm long; rachis slender, ridged, 13–22cm long; floral bracts minute, elliptic, obtuse, coarsely erose, convolute around ovary, 0.5–1.5 × c.0.5mm long. *Flowers* sub-verticillate, c.1mm long, uniformly pale green to yellow; pedicel and ovary c.1mm long. *Sepals* similar, ovate, reflexed, overlapping the ovary, entire, c.1mm long. *Petals* ovate, reflexed, overlapping on the ovary, erose, c.1mm long. Lip orbicular, indistinctly 3-lobed, 1–1.5 × 0.5–1mm; lateral lobes pectinate, erose; mid-lobe broad, transversely oblong, margins deeply fimbriate-erose to emarginate. Column very short. Fruit broadly ovoid, 3–4 × 1–2mm. **Plate 7.**

Bhutan: S – Sankosh district (Balu Khola 7km W of Phipsoo); **Darjeeling** (unlocalised *Clarke* and *Griffith* specimens); **Sikkim** (unlocalised *Pantling* specimen). In deciduous, subtropical forest 200–330m. Fl. October; Fr. March.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, Bangladesh, China (Hainan), and east to the Philippines, Malaysia, Indonesia and the Pacific islands.
ETYMOLOGY. From the Latin *mucronatus* (mucronate, abruptly terminated by a sharp point) in reference to the leaves.
NOTES. Seidenfaden (1992, 1997) reviewed the history and taxonomy of this species. Murti & Panigrahi (1999) proposed a new name for this species and had evidently overlooked the Ormerod & Seidenfaden combination referred to above and we reduce their name to synonymy here.

7. **O. pachyrachis** Rchb. f. ex Hook. f., Fl. Brit. India 5(2): 681 (1890). Types: India, Garhwal, *Falconer* 1009 (syn. K!); India, Kumaon, *Strachey* & *Winterbottom* 2 (syn. K!); India, Darjeeling, Punkabarrie (Pankhabari), *Hooker* s.n. (syn. K!).
Oberonia orbicularis Hook. f., Fl. Brit. India 5(2): 677 (1890). Type: India, Sikkim, Dikkeeling (Lusing), *Clarke* 9610 (holo. K!).
Indorchis orbicularis (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).
I. pachyrachis (Rchb. f. ex Hook. f.) Kuntze, loc. cit. (1891).
Oberonia umbraticola Rolfe in Bull. Misc. Inform. Kew 1909: 62 (1909). Type from Thailand

Plant terrestrial, 5–16cm tall; *roots* fasciculate. *Stem* short, tufted. *Leaves* ensiform, slightly falcate, tapering to base, acute, 2.5–11 × 0.4–1.1cm. *Inflorescence* densely many-flowered, verticillate, stout; peduncle short, broad, compressed, adnate to leaf apex, 0.5–1cm long; rachis fleshy, terete, tapering, erect, 2–10.5 × 0.2–0.7cm; floral bracts ovate-orbicular, irregularly, deeply serrate. *Flowers* sunk into pits in rachis, c.1mm long; sepals and petals dull orange-yellow to brown, lip deeper coloured. *Sepals* similar, elliptic, obtuse, glandular at back, lying on surface of rachis, c.0.5 × 0.25mm. *Petals* linear-oblong, obtuse, c.0.5 × 0.15mm. *Lip* orbicular-elliptic, obtuse, concave, slightly erose at apex, c.0.5 × 0.25mm; base with a deep depression under the column. *Column* simple, c.0.1mm long. *Fruit* short, swollen, 1–2 × 1–1.5mm.

Bhutan: S – Gaylegphug district (Betini (M.F.B.)); **Darjeeling** (Dumsong, above Ambyok, Pankhabari); **Sikkim** (Lusing, Valley of Tista River). 850m. Fl. December–March.

GENERAL DISTRIBUTION. N India, Nepal, Myanmar, China (Yunnan) and Thailand.
ETYMOLOGY. From the Greek *pachy-* (thick, stout) and *rachis* (the inflorescence axis).
NOTES. Pradhan (1979) examined living material from Darjeeling and felt that *O. orbicularis* should be treated as a synonym of *O. pachyrachis*. The older flowers agree with the description in King & Pantling (1898) and the younger flowers to that in Hooker (1895).

8. **O. pyrulifera** Lindl., Fol. Orchid. Oberonia 8: 3, no.15 (1859). Type: India, Khasya, Myrung, *Griffith* s.n. (holo. K-LINDL!).
Oberonia verticillata var. *khasiana* Lindl., Fol. Orchid. Oberonia 8: 3, no.14d (1859). Types: India, Khasia, *Lobb* s.n. (syn. K-LINDL!), Khasia, *Hooker* & *Thomson* 118 (syn. K-LINDL!).
Malaxis verticillata var. *khasiana* (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 210 (1861).
M. pyrulifera (Lindl.) Rchb. f., op. cit. 211 (1861).
Indorchis pyrulifera (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).

Plant stemless, 5–12cm tall; *roots* fasciculate. *Leaves* 3 or 4, ensiform, falcate to weakly falcate, acute to subacute, slightly fleshy, flabellate, overlapping at base, jointed, 2–6 × 0.3–0.7cm. *Inflorescence* subdense; peduncle slender, terete, ridged, bracteate, 2.5–4cm long; peduncle bracts linear, distant, 2–3mm long; rachis decurved, 3–7cm long; floral bracts lanceolate, acuminate, erose, 1.5–2.5 × c.0.5mm (at base). *Flowers* c.1mm long, uniformly green; pedicel and ovary 1–1.5mm long. *Sepals* similar, ovate, acute, entire, reflexed, 0.6–1mm long. *Petals* oblong, obtuse, reflexed, lying against ovary, 0.6–1mm long. *Lip* oblong, shortly 3-lobed, 1–2mm long; base truncate, with a central depression; lateral lobes auriculate; mid-lobe deeply divided into 2 oblong, weakly falcate, obtuse, divergent lobules, separated by a triangular sinus. *Column* short. *Fruit* ovoid-cylindric, ribbed, 1.5–2 × 1.5–2mm.

Bhutan: S – Gaylegphug district (Gaylegphug (M.F.B.)); **Sikkim** (Valley of Tista River), 330m. Fl. October–December.

GENERAL DISTRIBUTION. N India and China (Yunnan).

ETYMOLOGY. From the Latin, from a diminutive form of *Pyrus* (the pear) and the suffix *-fera* (carrying) in reference to the shape of the fruits.

NOTE. *O. pyrulifera* is closely related to *O. caulescens* and differs from that species in being stemless, and having the lateral lobes of the lip auriculate and not recurved.

Subgenus **Menophyllum** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 145 (1911).

9. **O. angustifolia** Lindl., Fol. Orchid. Oberonia 8: 5, no.29 (1859). Types: India, Darjeeling, *Griffith* s.n. (syn. K-LINDL!); India, Khasia, *Griffith* 1223 (syn. K-LINDL!); India, Khasia, *Hooker & Thomson* 111 (syn. K-LINDL!).

Oberonia iridifolia var. *angustifolia* (Lindl.) Hook. f., Fl. Brit. India 5(2): 676 (1890).

Iridorchis angustifolia (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).

Oberonia denticulata subsp. *angustifolia* (Lindl.) Panigrahi & Dubey in Proc. 8th Ann. Conf. Orissa Bot. Soc.: 2 (1983).

O. denticulata var. *angustifolia* (Lindl.) S. Misra in J. Orchid Soc. India 3(1–2): 70 (1989).

O. smisrae var. *angustifolia* (Lindl.) Panigrahi, Fl. Bilaspur Dist. 2: 593 (1999), **syn. nov.**

Plant 6–11cm tall; roots fasciculate. *Stem* leafy, covered by leaf sheaths, 2–5cm long. *Leaves* 4–6, sheathing at base, conduplicate, linear-lanceolate, acute, 1–2.5 × 0.1–0.4mm (including sheath). *Inflorescence* erect, verticillate, many-flowered; peduncle 1–2cm long; rachis 3.5–6cm long; floral bracts lanceolate, apiculate, apical margins erose, c.1mm long. *Flowers* c.0.5mm long, colour not known; pedicel and ovary 0.5–0.7mm long. *Sepals* similar, ovate-elliptic, acute, 0.5–0.55 × 0.4mm. *Petals* ovate, acute, margins erose, 0.4–0.5 × 0.3mm. *Lip* obscurely 3-lobed, 0.6–0.7 × 0.7mm (across lateral lobes when spread); lateral lobes broadly ovate, obtuse; mid-lobe subquadrate, divided at apex into 2 irregularly truncate lobes. *Column* 0.2–0.3mm tall. *Fruit* ovoid, 1.5–2 × 1.5–2mm. **Fig. 51.**

Darjeeling (unlocalised *Griffith* specimen).

GENERAL DISTRIBUTION. NE India (Meghalaya).

ETYMOLOGY. From the Latin *angusti-* (narrow) and *-folius* (leaved).

NOTE. Murti & Panigrahi (1999) reduced this to a variety of their *O. smisrae* (= *O. mucronata*), but we do not agree with this.

10. **O. brachystachys** Lindl., Sert. Orchid. 2: sub t.8b (1838). Type: Myanmar (Burma), *Griffith* 697–778 (holo. K-LINDL!).

Oberonia demissa Lindl., Fol. Orchid. Oberonia 8: 4, no.18 (1859). Type: India, Terai, *Hooker* 121 (holo. K-LINDL!).

Malaxis brachystachys (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 211 (1861).

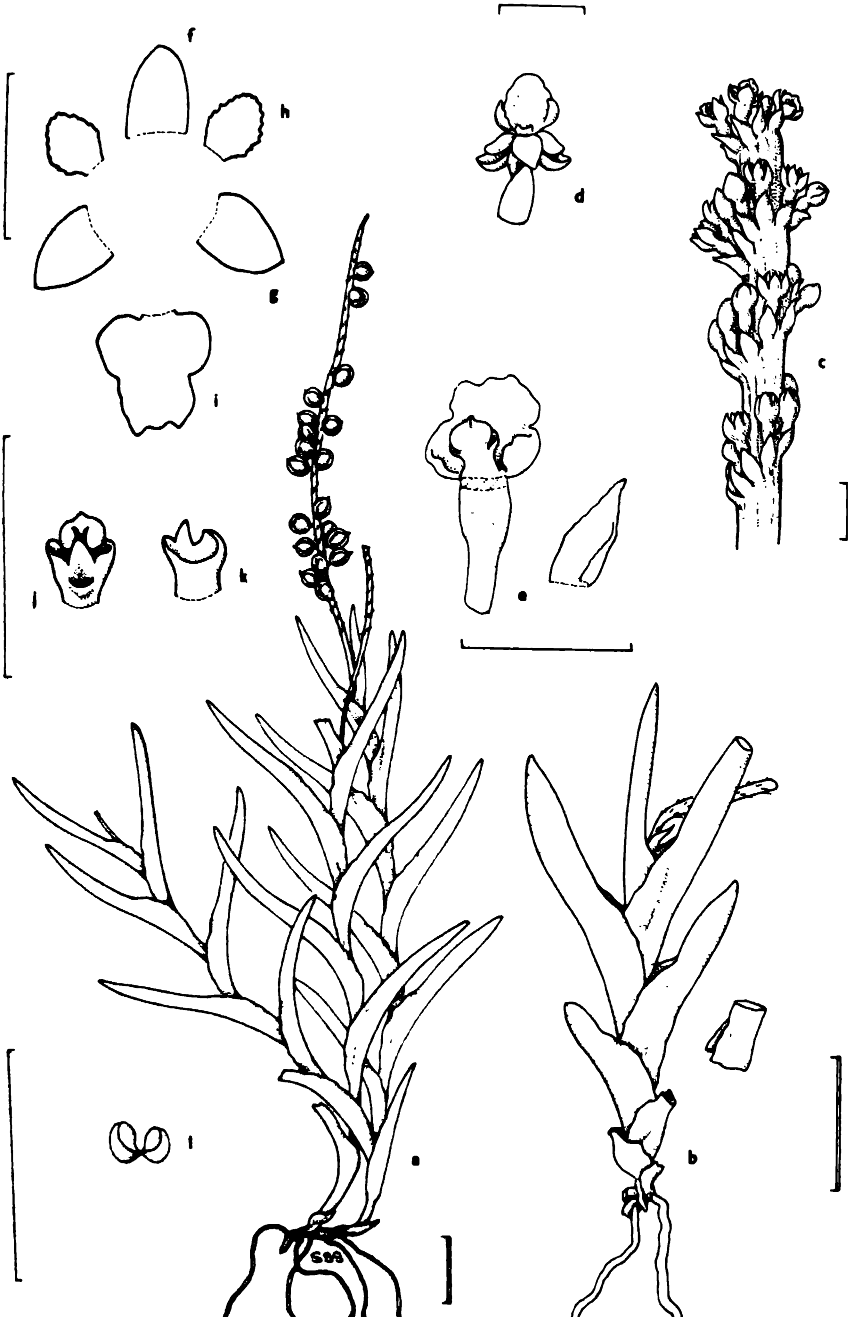


Fig. 51. **Oberonia angustifolia**: a, habit; b, stem (detail); c, flowering inflorescence; d, flower; e, lip, column and ovary, with detached bract; f, dorsal sepal; g, lateral sepals; h, petals; i, lip; j, column apex; k, column apex (back view, anther removed); l, pollinia. Drawn by Susanna Stuart-Smith from *Griffith* 1223 (K-LINDL).

M. demissa (Lindl.) Rchb. f., loc. cit. (1861).
Iridorchis brachystachys (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).
I. demissa (Lindl.) Kuntze, loc. cit. (1891).
Oberonia bambusicola Kerr in Bull. Misc. Inform. Kew 1927: 218 (1927). Type from Thailand.

Plant 4.5–7cm tall; roots fasciculate. *Stem* short. *Leaves* 3 or 4, oblong-lanceolate, subacute, weakly falcate, margins wavy to entire, overlapping at base, 3–6 × 0.5–1.4cm. *Inflorescence* erect to recurved, verticillate, densely many-flowered; peduncle ebracteate, axillary, 0.4–0.8cm long; rachis 3–5cm long; floral bracts lanceolate, subacute, margins obscurely crenulate, 1–1.5mm long. *Flowers* c.0.5mm across, uniformly reddish-brown; pedicel and ovary c.1mm long. *Sepals* subsimilar, ovate, entire, reflexed, c.0.5mm long. *Petals* elliptic, obtuse, erose-dentate, spreading, c.0.5mm long. *Lip* broadly 3-lobed, c. 0.5 × 0.8mm (when spread); lateral lobes oblong, obtuse, falcate, margins erose-dentate, diverging; mid-lobe quadrate-truncate, orbicular, apex emarginate, margins erose-dentate. *Column* c.0.2mm long.

Terai (unlocalised Hooker specimen); **Sikkim** (Valley of Tista River). In tropical valleys. Fl. July–October.

GENERAL DISTRIBUTION. Myanmar, Thailand and Malaysia.
ETYMOLOGY. From the Greek *brachy-* (short) and *stachys* (spike).
NOTE. The correct spelling of the epithet is *brachystachys* (Seidenfaden, 1978b) and not *brachystachya* (Seidenfaden, 1968).

11. **O. emarginata** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 6, t.2A (1898). Type: India, Sikkim, Namgah (Nanga), *Pantling* 423 (holo. CAL!, iso. BM! K! L! W!).
Oberonia micrantha King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 6, t.5 (1898). Type: India, Sikkim, Tendong, *Pantling* 324 (holo. CAL, iso. K!).

Plant erect or pendent, small, 3.5–9cm tall; roots fasciculate. *Stem* short. *Leaves* 5–7, linear-ensiform, acute to subacute, 1–3.5 × 0.2–0.3cm. *Inflorescence* erect, verticillate, densely many-flowered; peduncle bracteate, 1–1.5cm long; peduncle bracts linear, hyaline, c.1mm long; rachis 2–5.5cm long; floral bracts linear-lanceolate, acute, c.1 × 0.25mm long. *Flowers* c.0.75mm across, uniformly greenish to yellow orange; pedicel and ovary 0.5–0.75mm long. *Sepals* subsimilar, spreading, ovate, minutely papillose on outside, c.0.5 × 0.4mm; *dorsal sepal* entire, obtuse; *lateral sepals* subacuminate. *Petals* ovate, obtuse or acuminate, c.0.5 × 0.4mm. *Lip* 3-lobed, antrorse, 0.5–0.75 × 0.5–0.75mm; lateral lobes oblong to wedge-shaped, rounded at apex; mid-lobe quadrate to semi-orbicular, obscurely 2-lobed at apex, margins entire to dentate. *Column* c.0.3mm long.

Bhutan: S – Sankosh district (Daga Dzong, Seto Gompa); **Sikkim** (Nanga, Tendong). 1900–2000m. Fl. September.

GENERAL DISTRIBUTION. NE India and Thailand.
ETYMOLOGY. From the Latin *emarginatus* (shallowly notched), a reference to the lip apex.
NOTE. The lateral lobes of the lip of this species are narrow, rather fleshy and recurved which distinguishes it from the related *O. jenkinsiana* which has broad, spreading, denticulate lateral lobes.

12. **O. falcata** King & Pantling in J. Asiat. Soc. Bengal 64(3): 329 (1896). Type: India, Darjeeling, Labha, *Pantling* 218C (holo. CAL, iso. BM!).
Oberonia pendula Ridley in J. Straits Branch Roy. Asiat. Soc. 61: 38 (1912). Type from Malaysia.

Plant 10–24cm tall; roots fasciculate. *Stem* leafy, flexuose, covered by leaf sheaths, 6–12.5cm tall. *Leaves* 5 or 6, linear-ensiform, falcate, sheathing at base, 1.5–5 × 0.2–0.4cm (including base). *Inflorescence* erect, subverticillate, densely many-flowered; peduncle short, terete, 1–2cm long; rachis slender, 3–14cm long; floral bracts lanceolate, acute, hyaline, erose, 1–1.5 × 0.5–0.7mm. *Flowers* c.1mm across, uniformly pale green to yellowish-green; pedicel and ovary 1–1.5mm long. *Sepals* subsimilar, ovate-elliptic, acute, entire, reflexed to spreading, c.0.5mm long. *Petals* linear-oblong, obtuse, entire, c.0.5mm long. *Lip* 3-lobed, 1–1.5mm long; lateral lobes obtuse, forming small triangular projections; mid-lobe deeply divided into 2 long, lanceolate, diverging lobules with an emarginate sinus between. *Column* winged, c.0.2mm long.

Bhutan: S – Phuntsholing district (Kamji (M.F.B.)); **Darjeeling** (Labha); **Sikkim** (Chunthang, Lusing, Singhik, Sosing). In tropical valleys; 1330–1800m. Fl. July–October.

GENERAL DISTRIBUTION. N India, Nepal, Thailand, Vietnam and Malaysia.

ETYMOLOGY. From the Latin *falcatus* (curved like a sickle) in reference to the leaf shape.

NOTES. *O. falcata* resembles *O. caulescens* but differs in having non-jointed leaves and a denser inflorescence. Pantling collections with the number 454 have caused confusion because some sheets bear *O. falcata* and others *O. caulescens*.

Hara (1971) reported *O. falcata* from Bhutan; the collections he cited have been examined, but they have jointed leaf sheaths and are referrable to *O. acaulis* and *O. caulescens*.

13. **O. jenkinsiana** Griff. ex Lindl., Fol. Orchid. Oberonia 8: 4, no.20 (1859). Types: India, Assam, Deborro Mook, *Jenkins* s.n. (syn. K-LINDL!); India, Khasia, *Lobb* s.n. (syn. K-LINDL! p. p.).

Malaxis jenkinsiana (Griff. ex Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 211 (1861).

Indorchis jenkinsiana (Griff. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).

Plant 5–13cm tall; *roots* fasciculate. *Stem* short. *Leaves* 4 or 5, linear-ensiform, acute to subacute, 2–11 × 0.2–0.5cm. *Inflorescence* decurved, verticillate, densely many-flowered; peduncle bracteate, 1.5–3.5cm long; peduncle bracts filiform, 2.5–5mm long; rachis 2.5–8cm long; floral bracts filiform, 1–1.5mm long. *Flowers* c.1mm across, uniformly brownish-red; pedicel and ovary 0.6–1mm long. *Sepals* subsimilar, reflexed, c.0.5 × 0.4mm; *dorsal sepal* ovate, obtuse; *lateral sepals* ovate, subacute. *Petals* oblong, obtuse, subentire, c.0.5 × 0.25mm. *Lip* antrorse, 3-lobed, c.0.75 × 1.25mm (across lateral lobes when spread); lateral lobes oblong to wedge-shaped, truncate, denticulate; mid-lobe quadrate-oblong, obscurely 2-lobed at entire to irregular apex; disc obovate, concave. *Column* thick, clavate, subglobose, c.0.4mm long. *Fruit* ridged, c.3 × 1.5mm.

Sikkim (unlocalised *Pantling* specimen). 400–1200m. Fl. September–November.

GENERAL DISTRIBUTION. NE India, Myanmar, China and Thailand.

ETYMOLOGY. Named after Captain Francis Jenkins who collected the type specimen in Assam.

NOTE. This species is closely related to *O. clarkei* (see note under excluded species below).

14. **O. obcordata** Lindl., Fol. Orchid. Oberonia 8: 7, no.43 (1859). Types: India, Sikkim, *Hooker & Thomson* 112 (syn. K-LINDL!); India, Darjeeling, *Griffith* s.n. (syn. K-LINDL!); India, Khasia, *Griffith* s.n. (syn. K-LINDL!).

Malaxis obcordata (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 216 (1861).

Oberonia treutleri Hook. f., Fl. Brit. India 5(2): 683 (1890); Icon. Pl. ser.3(18): t.1786a (1889). Type: India, Sikkim, *Treutler* 1151 (holo. K!).

Indorchis obcordata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).

I. treutleri (Hook. f.) Kuntze, loc. cit. (1891).

Plant 5–9cm tall; *roots* fasciculate. *Stem* leafy, compressed, 2–4cm tall. *Leaves* linear, falcate, acute, fleshy, sheathing at base, 1.5–5 × 0.2–0.9cm. *Inflorescence* erect, verticillate, many-flowered; peduncle short, 0.5–1.5cm long; peduncle bracts few; rachis slender, 1.5–6cm long; floral bracts ovate-lanceolate, acuminate, minutely toothed, verticillate, 2.5–3.5 × 1–1.5mm. *Flowers* clustered within whorls of floral bracts, uniformly reddish-brown to pink; pedicel and ovary 0.5–1mm long. *Sepals* subsimilar, broadly ovate, 0.5–0.8mm long; *dorsal sepal* acute; *lateral sepals* obtuse. *Petals* linear-oblong, subacute, spreading, c.0.5mm long. Lip 3-lobed, 1–1.5mm long; lateral lobes divergent, oblong, obtuse, entire; mid-lobe reniform, ridged in centre, lobules separated by a shallow sinus, margins entire. *Column* very short. Fruit ovoid, 2–2.5 × 1–1.5mm.

Darjeeling (Damsong Reserved Forest, Kalimpong, above Pankhabari); **Sikkim** (Rimbi Chhu, Yak La). 1660–3000m. Fl. July–December; Fr. February.

GENERAL DISTRIBUTION. NE India, China and Thailand.
ETYMOLOGY. From the Latin *obcordatus* (reverse-cordate) probably a reference to the lip.
NOTE. *O. obcordata* has long, verticillate floral bracts enclosing small flowers giving the inflorescence a unique, millipede-like appearance.

15. **O. pachyphylla** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 5, t.4 (1898). Type: India, Sikkim-Himalaya, Salgurra (Salgara), *Pantling* 429 (CAL).
Oberonia apiculata Kerr in Bull. Misc. Inform. Kew 1927: 212 (1927). Type from Thailand.
O. crassirachis Guillaumin in Bull. Mus. Natl. Hist. Nat. sér.2, 35(6): 648 (1963). Type from Vietnam.

Plant 3–4cm tall; *roots* fasciculate. *Stem* very short, not tufted. *Leaves* very fleshy, especially at base, broadly lanceolate, acute 1.5–2.5 × 0.5–0.7cm (at base). *Inflorescence* fleshy, terete, verticillate, densely many-flowered; peduncle short, stout, not adnate to leaf, 1.3–1.5cm long; peduncle bracts 1–3 lanceolate, c.1mm long; rachis deflexed, thick, tapering towards apex, 1.5–3cm long; floral bracts ovate-orbicular, erose, fleshy, acute, c.1.5 × 0.8mm. *Flowers* c.8mm long, not sunk into rachis; sepals and petals pale reddish-brown, lip darker. *Sepals* similar, spreading, broadly ovate, obtuse, entire, 1–1.5mm long. *Petals* spreading, ovate-lanceolate, obtuse, entire, 1–1.5mm long. *Lip* 3-lobed, shorter than the sepals and petals, ovate-orbicular, pitted at base under column, c.1mm long; lateral lobes long, narrow, erose-dentate; mid-lobe rounded, entire. *Column* c.0.2mm long.

Terai (Salgara (King & Pantling, 1898)).

GENERAL DISTRIBUTION. India (W Bengal), Thailand and Vietnam (see note below).
ETYMOLOGY. From the Greek *pachy-* (thick) and *phyllon* (leaf).
NOTES. King & Pantling (1898) commented that this little-known species resembled *O. pachyrachis* and *O. orbicularis*, and had been collected only once. The inflorescence is not adnate to the leaf and the flowers are not sunk into the rachis; the flowers are similar to those of *O. orbicularis* but differ in that the lip has lateral lobes. Ansari & Balakrishnan (1990) had seen the type specimen (CAL), and included it in the section of plants with non-jointed leaves as did Seidenfaden (1968, 1978b). Seidenfaden included *O. apiculata* Kerr and *O. crassirachis* Guillaumin in the synonymy, but the leaves of the type of *O. apiculata* are definitely jointed. Further study of this little known species is required to clarify the taxonomy.

16. **O. prainiana** King & Pantling in J. Asiat. Soc. Bengal 64(3): 331 (1896). Type: India, Darjeeling, Sivok, Teesta (Tista) Valley, *Pantling* 225 (holo. CAL!).
Oberonia brunnescens Ridley in J. Linn. Soc., Bot. 32: 220 (1896). Type from Malaysia (Perak).

Plant pendent. *Stem* short. *Leaves* not jointed, oblong-ovate, acute, c.2.5 × 1cm. *Inflorescence* verticillate; peduncle indistinct, terete, c.2cm long; rachis c.9cm long; floral bracts oblong-lanceolate, acuminate, subentire to irregularly serrate, sparsely gland-dotted, c.0.75 × 0.25mm. *Flowers* c.1.25 × 0.5mm, uniformly brown; pedicel and ovary c.0.75mm long. *Sepals* subsimilar, entire, reflexed and coiled in flower; *dorsal sepal* oblong, acute, c.0.5 × 0.25mm; *lateral sepals* ovate, obtuse, c.0.5 × 0.5mm. *Petals* oblanceolate-elliptic, obtuse, margins irregularly dentate, reflexed, c.0.75 × 0.25mm. *Lip* antrorse, ovate, unlobed, obtuse, margins lacerate-dentate, glabrous, glandular, c.0.75 × 0.5mm. *Column* broad, thick, c.0.23mm long.

Darjeeling (Sivok, Tista River Valley). 500–1500m. Fl. April–June.

GENERAL DISTRIBUTION. E Himalaya; doubtful elsewhere (Seidenfaden, 1968).
ETYMOLOGY. Named after Sir David Prain (1857–1944), one time Curator of the Calcutta Herbarium, who became Director of the Royal Botanic Gardens, Kew in 1905.
NOTE. This species can be distinguished by its unlobed lip.

17. **O. recurva** Lindl. in Bot. Reg. 25: misc.14, no.8 (1839). Type: India, Bombay, cult. Loddiges (holo. K-LINDL!).
Oberonia setifera Lindl., Fol. Orchid. Oberonia 8: 3, no.11 (1859). Type: India, Concan, *Dalzell* 38 (holo. K-LINDL!).
Malaxis setifera (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 210 (1861).
M. recurva (Lindl.) Rchb. f., *loc. cit.* 212 (1861).
Iridorchis recurva (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).
Oberonia parvula King & Pantling in J. Asiat. Soc. Bengal 64(3): 330 (1896). Type: India, Darjeeling, Gorubathan, *Pantling* 203 (holo. CAL, iso. BM!).
O. croftiana King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 7, t.6A (1898). Type: Sikkim–Bhotan frontier, Jaldakha river, *Pantling* 254 (holo. CAL!, iso. BM! K! W!).
O. lingmalensis Blatter & McCann in J. Bombay Nat. Hist. Soc. 35: 255 (1931). Type: India, W Ghats, *Blatter & Hallberg* 1681 (holo. BLAT).
O. myriantha var. *parvula* (King & Pantling) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 76 (1951).

Plant 2.7–8cm tall; roots fasciculate. Stem short. *Leaves* 3 or 4, ensiform-lanceolate, tapering to an acute apex, straight to weakly falcate, overlapping at base, 0.7–3 × 0.15–0.5cm. *Inflorescence* erect to decurved, densely many-flowered; peduncle terete, stout, bracteate, 0.5–1.5cm long; peduncle bracts lanceolate, acute, c.1mm long; rachis terete, grooved, 3.5–6cm long; floral bracts oblong-lanceolate to elliptic, subacute, crenulate to subentire, 0.6–1.5mm long. *Flowers* c.1mm across, uniformly reddish-brown; pedicel and ovary short, c.1mm long. *Sepals* similar, ovate-cordate, entire, spreading, 0.5–0.8 × 0.3–0.4mm. *Petals* oblong, obtuse, weakly crenulate to entire, 0.4–0.7 × 0.3–0.4mm. Lip oblong, 3-lobed, 0.6–1 × 0.5–0.8mm; base with a large depression; lateral lobes orbicular, erose-dentate; midlobe with 2 long, obtuse, orbicular, incurved lobules, separated by a deep, obtuse sinus. Column 0.1–0.2mm tall. Fruit ovoid, 1.5–2 × 1–1.5mm.

Darjeeling (Gorubathan); **Sikkim** (Lusing, Tista River Valley). In tropical valleys. Fl. October–February.

GENERAL DISTRIBUTION. India and China.
ETYMOLOGY. From the Latin *recurvus* (curved backwards) in reference to the inflorescence.
NOTE. *O. recurva* is related to *O. rufilabris* but lacks the filiform peduncle bracts and has a differently shaped lip. We follow Seidenfaden (1968) in his treatment of *O. croftiana* and *O. parvula* as synonyms.

18. **O. rufilabris** Lindl., Sert. Orchid. 2: t.8a (1838). Type: Myanmar (Burma), Moulmein, Griffith 1834 (holo. K-LINDL!).
Malaxis rufilabris (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 213 (1861).
Iridorchis rufilabris (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).
O. pantlingiana Shakya & R.P. Chaudhary in Harvard Pap. Bot. 4(1): 360 (1999). Type: India, Dooars, *Pantling* 430 (holo. CAL, iso. BM! K! W!).

Plant 8–15cm tall; roots fasciculate. Stem short. *Leaves* linear-oblong, weakly ensiform, overlapping-flabellate at base, margins entire to wavy, 2.5–6 × 0.4–1.1cm. *Inflorescence* erect, verticillate, densely many-flowered; peduncle short, bracteate, 1–1.5cm long; peduncle bracts filiform, soft, 2–4mm long; rachis 4.5–12cm long; floral bracts ovate with long filiform tips, entire, 1–2.5mm long. *Flowers* 0.6–1mm across, uniformly reddish-brown; pedicel and ovary c.0.5mm long. *Sepals* similar, ovate, acute, concave, spreading, 0.6–1mm long. *Petals* linear-oblong, subacute, entire, spreading, 0.6–1mm long. *Lip* fleshy, narrow, minutely scabrid, 1–1.5mm long; base with a minute, elongate pit; lateral lobes filiform, deflexed and recurved; mid-lobe narrow, deeply divided into 2 lanceolate lobules, separated by a deep sinus with an obtuse apex; mid-lobe lobules c.0.5mm long. Column toothed, c.0.2mm long. Fruit ridged, warty, 3–4 × 1.5–2mm.

Duars (E of Jaldhaka River). On branches, over streams in cool places; 1660m. Fl. February–March.

GENERAL DISTRIBUTION. NE India, Nepal, China, Thailand, Cambodia, Vietnam and Malaysia.
ETYMOLOGY. From the Latin *rufus* (reddish) and *labrum* (lip) in reference to the flower colour.
NOTES. The filiform peduncle bracts and the long inflorescence in relation to the size of the plant distinguish this species.

Shakya & Chaudhary (1999) considered that *Pantling* 430 from Sikkim represented a new species distinct from *O. rufilabris* in that it was larger, had flaccid leaves, a narrower lip and mid-lobe lobules that were smaller and parallel. We have examined both the type material and the Pantling collections at Kew and do not find these distinctions to be consistent. The Griffith type material is exactly the same size as the Pantling specimens and the length of the mid-lobe lobules is highly variable in the latter. It is possible that there are local varieties of this species but, until further living collections have been examined, we prefer to treat the Pantling material as conspecific.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

O. **anthropophora** Lindl., Gen. Sp. Orchid. Pl.: 16 (1830). Type: Myanmar (Burma), Tavoy, coll. W Gomez Wall. Cat. 1951 (holo. K-LINDL!, iso. K-W!).

NOTE. Reported by Hegde & Rao (1982a, 1983b) from Sessa in the W Kameng district of Arunachal Pradesh.

O. **clarkei** Hook. f., Icon. Pl. ser.3(18): t.1779a (1888). Type: India, Khasia Mountains, Shillong, *Clarke* 5818 (holo. K!).
Iridorchis clarkei (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 669 (1891).

NOTES. *O. clarkei* is known only from the type collection which is of poor quality though there are drawings by Hooker associated with the specimen. Seidenfaden (1968) considered it to be distinct from the related *O. jenkinsiana* in that the leaves and inflorescence are smaller. Ansari & Balakrishnan (1990) excluded it from their study because there is no material in Indian herbaria. It is difficult, from the available material, to be certain of the status of this plant but having examined the type material we suspect that it will turn out to be conspecific with *O. jenkinsiana*.

O. **katakiana** A.N. Rao in J. Econ. Taxon. Bot. 20(3): 711 (1996). Type: India, W Kameng district, Tipi, *A.N. Rao* 26077 (holo. Orchid Herbarium Tipi, iso. ASSAM CAL).

NOTE. We have seen no material of this species which is closely related to *O. caulescens*.

O. **maxima** Parish ex Hook. f., Fl. Brit. India 5(2): 677 (1890). Type: Myanmar (Burma), Moulmein, *Parish* 287 (holo. K!).

NOTE. Reported by Rao (1975) from Kalaktang in the Kameng district of Arunachal Pradesh.

O. **sulcata** Joseph & S. Chowdhery in J. Bombay Nat. Hist. Soc. 63: 54 (1966). Type: India, Arunachal Pradesh, Kameng, Bombi La, *Joseph* 40358 (holo. CAL, iso. ASSAM).

NOTE. This species is closely related to *O. recurva* Lindl. but is generally a rather larger plant, with yellow-brown flowers and distinctly serrate petal margins. We have not seen the type, but suspect that it may be a large form of *O. recurva*.

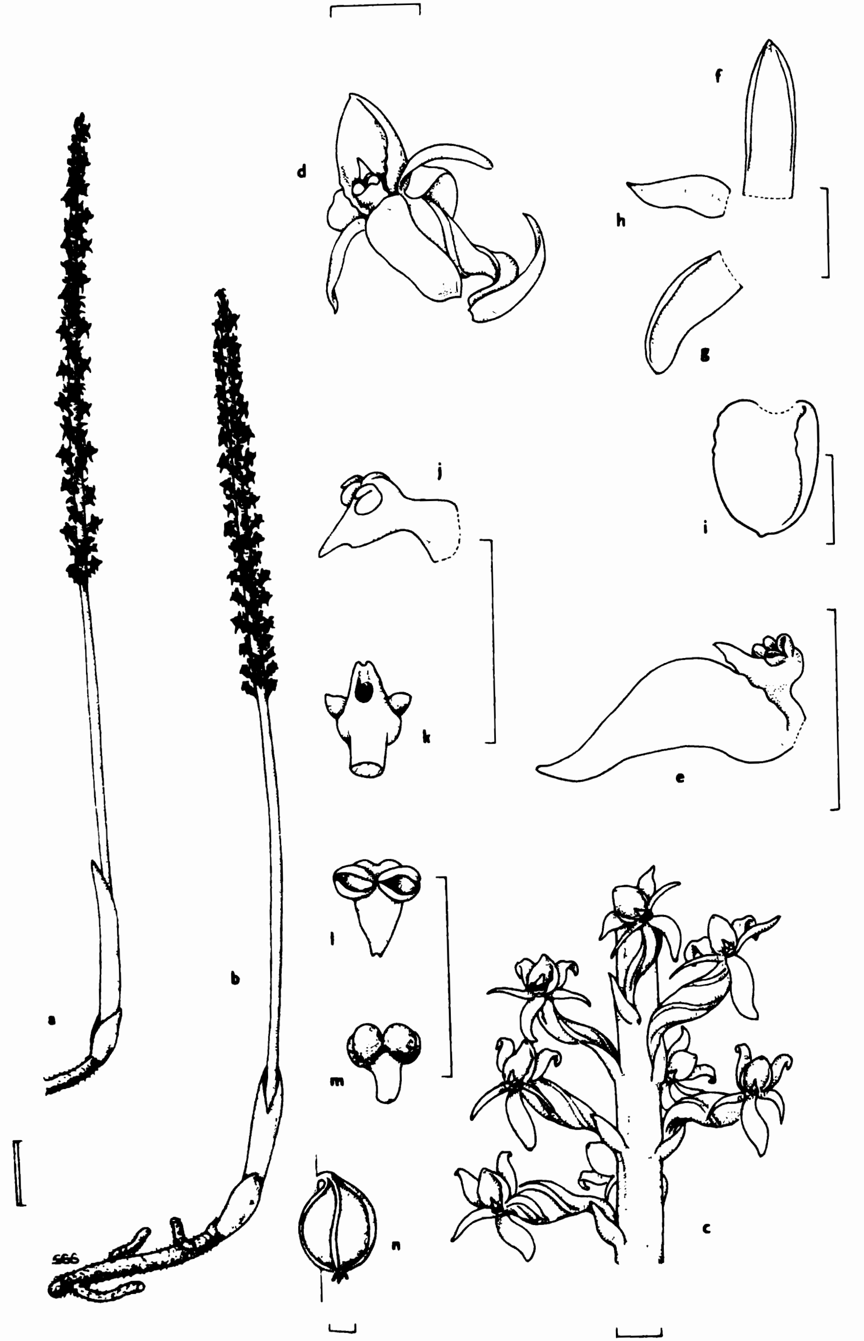


Fig 52. **Risleya atropurpurea**: a, habit; b, habit; c, inflorescence; d, flower; e, lip and column; f, dorsal sepal; g, lateral sepal; h, petal; i, lip; j, column (side view); k, column (back view); l, anther cap; m, pollinarium; n, fruit Drawn by Susanna Stuart-Smith. a–l and n from *Pantling* 451 (K); m from *Wilson* 4575 (K).

51. **Risleya** King & Pantling

Plants small, terrestrial, mycotrophic, leafless, rhizomatous, lacking tuber or pseudobulb. *Stem* with basal sheaths. *Inflorescence* terminal, racemose, densely many-flowered. *Flowers* minute, fleshy. *Sepals* and *petals* subequal, oblong, obtuse, spreading. *Lip* adnate to base of column, broadly ovate, fleshy, slightly crenulate near base; apex obtuse, with a small, upturned apiculus. *Column* short, terete; rostellum stout, elongate; anther dorsal, persistent, membranous; pollinia 4, in 2 pairs, waxy.

The genus *Risleya* was described in 1898 by Sir George King (1840–1909) and Robert Pantling (1856–1910) in their *Orchids of the Sikkim Himalaya* (published in the *Annals of the Royal Botanic Garden, Calcutta*). The genus is monotypic and occurs from the E Himalaya to N Myanmar.

TYPE. *Risleya atropurpurea* King & Pantling.
ETYMOLOGY. Named after H.H. Risley of the Bengal Civil Service, a distinguished ethnologist and author of the *Tribes and Castes of Bengal* (1891).

1. **R. atropurpurea** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 247, t.328 (1898). Type: India, Sikkim, Dzongri, R. *Pantling* 451A (holo. CAL, iso. K! E!).

Plant 8–22cm tall; rhizome pubescent. *Stem* glabrous, ridged, 5–13cm long; basal sheaths 2, tubular, wide, obtuse, 1–3cm long. *Inflorescence* cylindric; rachis 3–6.5cm long; floral bracts lanceolate, acute, 1–1.5mm long. *Flowers* to 1mm across, uniformly deep blackish-purple; pedicel and ovary twisted, 1–1.5mm long. *Sepals* subequal, oblong, obtuse, spreading, 1-veined, 1–1.75 × 0.6mm. *Petals* lanceolate, acute, 1-veined, 0.6 × 0.45mm. *Lip* simple, adnate to base of column, fleshy, slightly crenulate near base, 1.4–2 × 1.2–1.3mm; apex obtuse, with a small upturned apiculus. *Column* terete, 0.4–0.5mm tall; rostellum stout, elongate, c.0.2mm long. *Fruit* ovoid, 2–3 × 1.5–2mm. **Fig. 52.**

Bhutan: N – Upper Mo Chu/Upper Pho Chu district (Kangla Karchu La); **Sikkim** (Dzongri, Tangkar La, near Jamlinghang). In *Juniperus* and *Picea* forest, leaf litter under *Rhododendron hodgsonii*; 3500–4200m. Fl. June–July.

GENERAL DISTRIBUTION. China (Xizang), Myanmar.
ETYMOLOGY. From the Latin *atro-* (black, dark) and *purpureus* (purple), the colour of the whole plant.

Tribe **Calypsoeae** Dressler

52. **Cremastra** Lindl.

Plants terrestrial. *Pseudobulbs* clustered, ovoid, 1- or 2-leaved. *Leaves* plicate, erect or suberect, subtended by a tubular sheath. *Inflorescence* racemose, secund, lateral, erect, unbranched, laxly to densely few- to many-flowered. *Flowers* resupinate, pendent, narrowly tubular. *Sepals* and *petals* similar, linear-spathulate, free, not spreading. *Lip* free, slender, 3-lobed; base slightly saccate, callose. *Column* elongate, slender, clavate; pollinia 4, appressed in 2 pairs, attached directly to a semi-circular viscidium.

The genus *Cremastra* was established in 1833 by John Lindley in his *Genera and Species of Orchidaceous Plants*. Lund (1987b) revised the genus and we follow her treatment here. The genus comprises two species distributed in Nepal, NE India, Bhutan, Thailand, China, Taiwan and Japan.

No information exists on the pollination of this species but Lund (1987b) considered that bee pollination was likely.

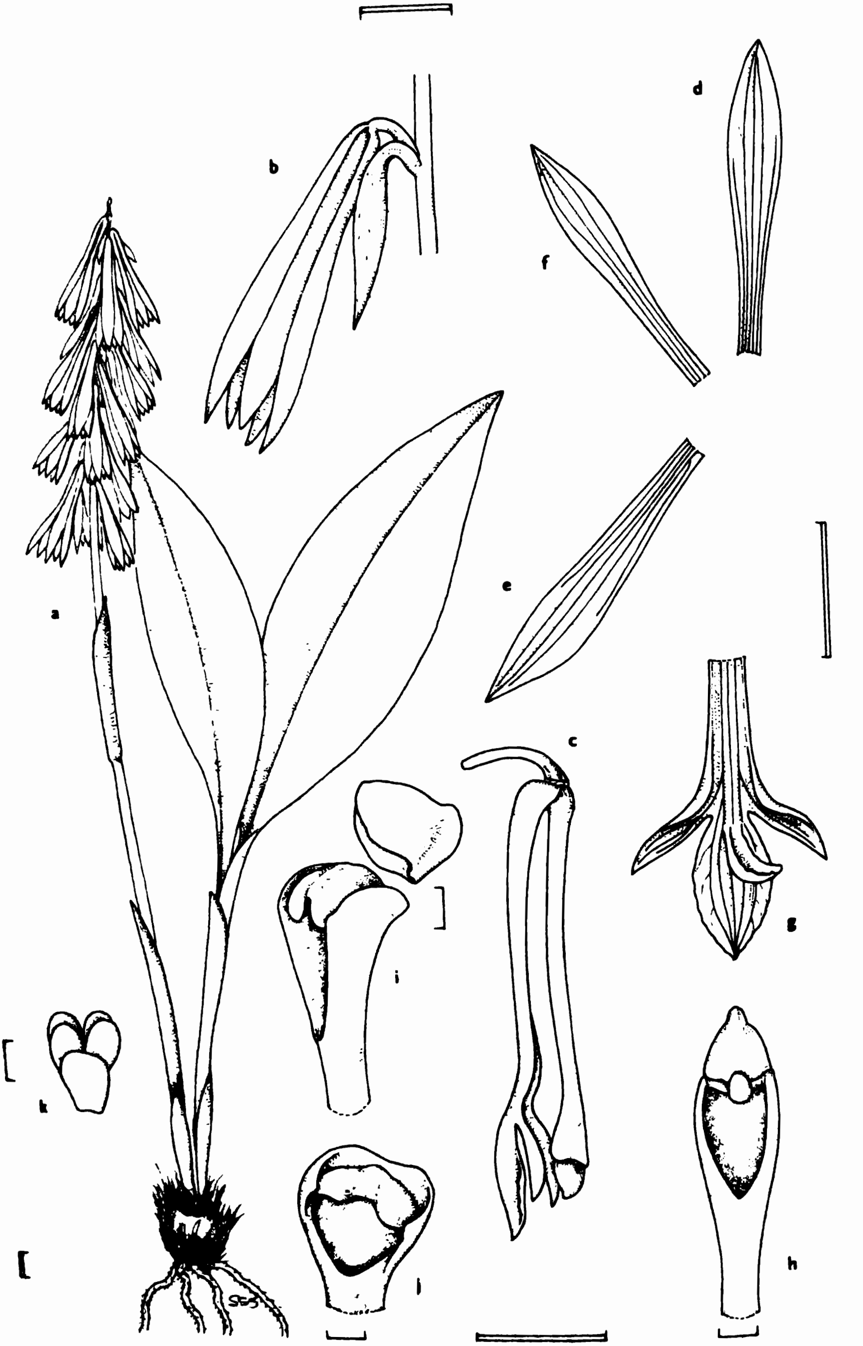


Fig. 53. **Cremastra appendiculata**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, **petal**; g, lip; h, column apex; i, column apex with detached anther cap; j, column apex (detail); k, pollinarium. Drawn by Susanna Stuart-Smith, a from *Pawling* 142 (K); b–k from *Clarke* 27863 (K).

TYPE. *Cremastra appendiculata* (D. Don) Makino; basionym: *Cymbidium appendiculatum* D. Don.
ETYMOLOGY. From the Greek *cremastra* (stalk of flower) in reference to the long, pendent pedicel and ovary.

1. **C. appendiculata** (D. Don) Makino in Bot. Mag. (Tokyo): 24 (1904). Lectotype: Nepal, coll. *Wallich* Wall. Cat. 7349 p.p. (lecto. W!, isolecto. BM! K-LINDL! K-W!), designated by Lund in Nordic J. Bot. 8: 199 (1987).
Cymbidium appendiculatum D. Don, Prodr. Fl. Nepal.: 36 (1826).
Cremastra wallichiana Lindl., Gen. Sp. Orchid. Pl.: 173 (1833). Type: Wallich collection cited above.
Aplectrum appendiculatum (Bl.) F. Maekawa, Wild Orchids of Japan in Colour: 60 (1971).
Cremastra triloba Hayata, Icon. Pl. Formos. 2: 135 (1912). Type from Taiwan.
C. appendiculata var. *triloba* (Hayata) Ying, Chinese Flowers: 4, t.3 (1976).

var. appendiculata

Plant 20–63cm tall. *Pseudobulbs* subterranean, 1.3–4 × 0.9–2.5cm. *Leaves* 1 or 2, narrowly elliptic, 3-veined, plicate, petiolate, 12–51 × 1.5–9(–13)cm; petiole 3–13cm long. *Inflorescence* 3- to 30-flowered; peduncle sheathed; sheaths 1–2.5cm long; rachis 8–15cm long; floral bracts lanceolate, 0.6–2.2 × 0.09–0.5cm. *Flowers* to 4cm long, pink, purplish, rarely yellow or white, petals and lip dark spotted; pedicel and ovary 3–5mm long. *Sepals* and *petals* similar, linear, widening at apex, connivent to form a tube at base; *dorsal sepal* 1.9–4 × 0.2–0.6cm; *lateral sepals* 2.2–3.7 × 0.1–0.6cm; *petals* 2–4 × 0.1–0.4cm. *Lip* 3-lobed, dilated, saccate at base, 2–4 × 0.1–0.6cm; lateral lobes narrowly oblong, 2–9mm long; disc with a large warty process towards apex. *Column* with a small foot, 1.8–3 × 0.1–0.4cm; anther cap 1–3mm long; pollinia 4, laterally flattened. *Fruit* cylindric, 2–3 × 0.7–1.6cm. **Fig. 53.**

Bhutan: S – Phuntsholing/Chukka (c.8km S of Gedu) and Gaylegphug (Gale Chu) districts; C – Punakha (Rimchu to Khosa (F.E.H.2)) and Tashigang (Shapang, Tashi Yangtsi Chu) districts; **Darjeeling** (Manibhanjam to Bhotia Basti, Parmaguri, Senchal Forest); **Sikkim** (Lusing, Rimbi Chhu). In dense forest, among fallen trees, in shade of very humid broad-leaved forest among *Girardinia*; 1830–2330m. Fl. April–May.

GENERAL DISTRIBUTION. Nepal, India, China, Taiwan and Japan.
ETYMOLOGY. From the Latin *appendiculatus* (with small appendages), possibly a reference to the warty lip callus.
NOTES. Lund (1987b) distinguished this variety from var. *variabilis* (Bl.) I.D. Lund which occurs in Thailand, China and Japan and has definite column wings and a smaller, glabrous lip callus. She also mentioned that the flowering time extended until October, but we believe this to be a mistake based on a misidentification of a collection at K (*Clarke* 25418) which has now been determined as *Calanthe densiflora*.

53. Didiciea King & Prain ex King & Pantling

Plants terrestrial; pseudobulbous. *Leaf* solitary, arising from side of pseudobulb. *Inflorescence* racemose. *Flowers* small. *Sepals* and *petals* similar, free, spreading, narrow. *Lip* sessile on base of column, fleshy, concave, ovate-oblong, entire; spur minute. *Column* wingless; anther terminal, convex, broad; pollinia 4, free, waxy, lacking appendages.

The genus *Didiciea* was described in 1896 by King and Pantling in the *Journal of the Asiatic Society of Bengal*. It is closely related to *Tipularia* but the pollinia have no appendages, the lip is unlobed and the spur is minute. The genus has two species, one found in India, the other in Japan.

TYPE. *Didiciea cunninghamii* King & Prain ex King & Pantling.
ETYMOLOGY. From the initials of David Douglas Cunningham (1843–1914), a British physician in the Indian Medical Service and the collector of one of the type specimens.

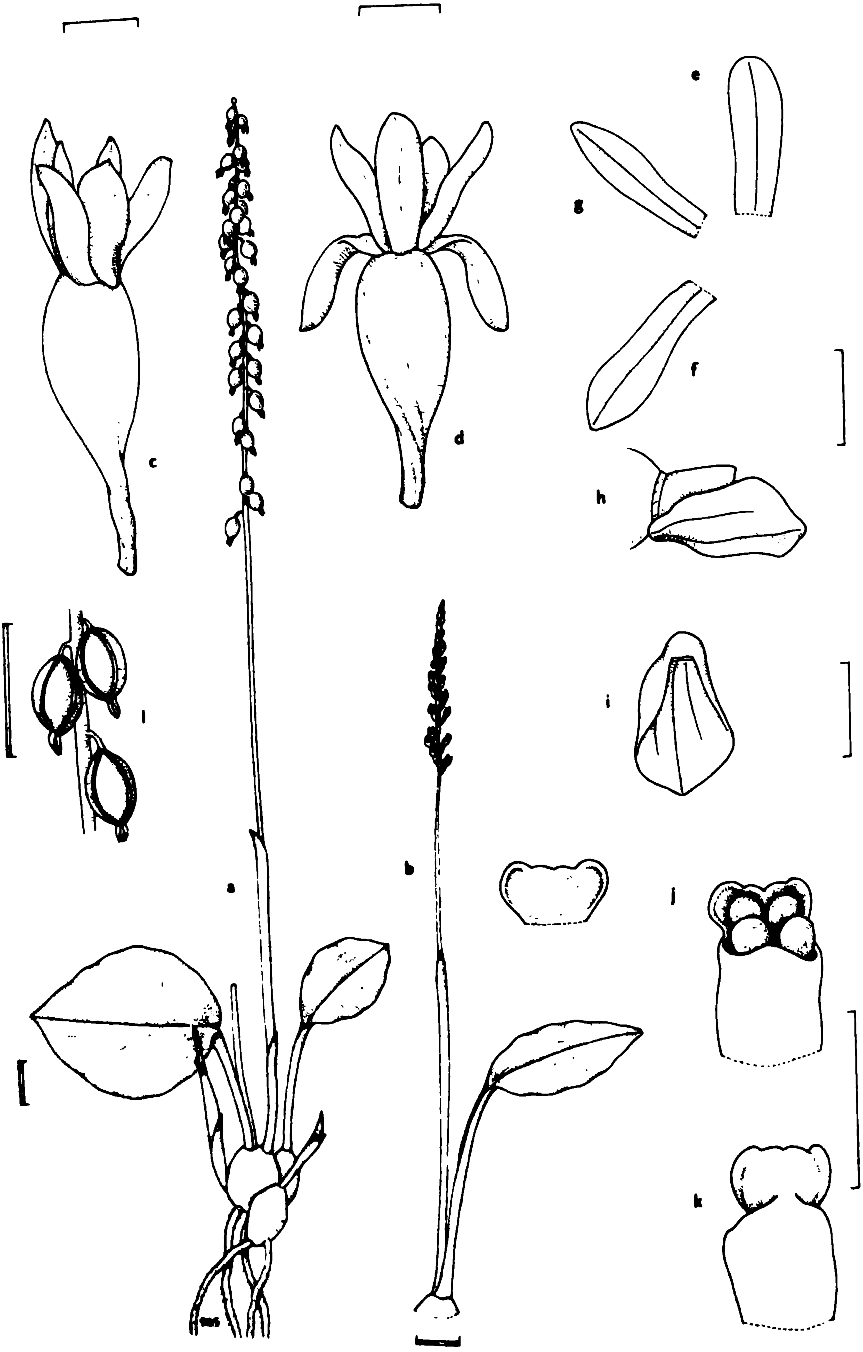


Fig. 54. **Didiciea cunninghamii**: a, habit (fruiting); b, habit (flowering); c–d, flower; e, dorsal sepal; f, lateral sepal; g, petal; h, lip (attached to column); i, lip; j, column apex (with detail of anther cap); k, column apex (back view); l, fruit. Drawn by Susanna Stuart-Smith, a and l from *Bhattacharya* 29389 (K); b–k from *Pantling* 396 (K).

1. **D. cunninghamii** King & Prain ex King & Pantling in J. Asiat. Soc. Bengal 65(2): 118 (1896). *Types*: India, Sikkim, Lachen Valley, *Cunningham* s.n. (syn. CAL!); Lachen Valley, *Pantling* 396 (syn. CAL!, isosyn. BM! K!).

Plant 13–19cm tall. *Pseudobulb* ovoid, c.1 × 1cm. *Scape* from apex of pseudobulb, bearing 1–3 convolute sheathing bracts, 9–14cm long. *Leaf* petiolate, broadly ovate, acute to subacute, 3-veined, margins undulate, 2.5–3.5 × 1.3–2cm; petiole linear, 1–2.5cm long. *Inflorescence* laxly few-flowered; rachis 1.3–3.5cm long; floral bracts lanceolate-triangular, c.0.3mm long. *Flowers* c.4mm long, colour not known; pedicel and ovary 1–3mm long. *Sepals* and *petals* similar, narrowly oblong, obtuse, c.1mm long. *Lip* shortly spurred, oblong, c.1mm long. *Column* c.0.5mm long; pollinia 0.15mm across. *Fruit* ovoid, 3–5 × 2–3mm. **Fig. 54.**

Sikkim (Lachen Valley). 4000m. Fl. July.

GENERAL DISTRIBUTIONS. Endemic.

ETYMOLOGY. Named after David Douglas Cunningham (see above), who collected one of the type specimens in Sikkim.

54. Oreorchis Lindl.

Terrestrial herbs; *rhizomes* pseudobulbous; pseudobulbs underground, with several internodes. *Leaves* 1 or 2, erect, plicate, linear to lanceolate, petiolate. *Inflorescence* lateral from pseudobulb, racemose, usually several- to many-flowered. *Flowers* spirally arranged, small to medium in size. *Sepals* and *petals* free, subsimilar, spreading or porrect; *mentum* formed by lateral sepal base absent or, if present, short. *Lip* 3-lobed or entire, clawed, spurless, usually with a callus. *Column* with a short foot; anther terminal, operculate; pollinia 4, globose to subglobose, superposed; stipe a hamulus; stigma entire, concave, oval.

The genus *Oreorchis* was established in 1859 by John Lindley (1799–1865) in the *Journal of the Proceedings of the Linnean Society*. In 1840 he had described two aberrant species of *Corallorhiza*, *C. foliosa* Lindl., from the W Himalaya, and *C. patens* Lindl., from Siberia. Their floral structure was similar to the genus *Corallorhiza* but they possessed leaves. Later, in 1859, he re-examined them, along with a third species in his possession, and proposed the new genus *Oreorchis* for them. The genus has recently been monographed by Pearce & Cribb (1996, 1997). The genus comprises 16 species distributed in the montane regions of the W Himalaya, SW China, north to Manchuria, Siberia and the islands of Japan and Taiwan.

Shatalkin (in Khrapko, 1990) recorded the pollination of *O. patens* in Russia by *Episyrphus balteatus* and *Sphaerophata menthastri* (Diptera) and Pearce & Cribb (1997) suggested that that some species might be autogamous.

LECTOTYPE. *Oreorchis patens* (Lindl.) Lindl.; basionym: *Corallorhiza patens* Lindl.

ETYMOLOGY. From the Greek *oreo-* (of mountains) and *orchis* (testicle, orchid) in reference to the montane habitat of members of this genus.

Key to species

1. Lip simple 2
+ Lip 3-lobed 3

2. Lip lacking a callus .... **1b. O. foliosa** var. **indica**
+ Lip with a callus .... **3. O. sanguinea**

3. Plant with 1 leaf .... **1a. O. foliosa** var. **foliosa**
+ Plants with 2 leaves .... **2. O. micrantha**

1. O. **foliosa** (Lindl.) Lindl. in J. Proc. Linn. Soc., Bot. 3: 27 (1859). Type: India, Mussoree, *Royle* s.n. (holo. K-LINDL!).

Corallorhiza foliosa Lindl. in Royle, Ill. Bot. Himal. Mts. 1: 362 (1839) nom. nud.; Gen. Sp. Orchid. Pl.: 535 (1840).

Kitigorchis foliosa (Lindl.) F. Maekawa, Wild Orchids of Japan in Colour: 469 (1971).

1a. var. **foliosa**

Plant c.35cm tall; roots fleshy, with fibrous strands. *Pseudobulbs* corm-like, to c.1.3 × 1.3cm tall. *Scape* c.30cm tall, lower part enclosed by tubular sheaths; sheaths c.4cm long. *Leaf* 1 from pseudobulb apex, oblong-lanceolate, acuminate, narrowed to a short petiole, c.35 × 2.5cm. *Inflorescence* laxly to densely up to 10-flowered; floral bracts lanceolate, acute, c.5mm long. *Flowers* c.6mm long; sepals and petals red, purple to yellowish-white, lip white with purple spots, column yellow; pedicel and ovary c.6mm long. *Dorsal sepal* linear-lanceolate, acute, 5-veined, c.8mm long; *lateral sepals* oblong-lanceolate, falcate, acute, 5-veined, c.7.5mm long, united to form a short mentum. *Petals* oblong-lanceolate, falcate, acuminate, 5-veined, c.9mm long. *Lip* adnate to column foot, 3-lobed, long-clawed, c.7.5 × 3.5mm; lateral lobes falcate, oblong, obtuse, deflexed; mid-lobe suborbicular to subreniform, emarginate; disc with 2 longitudinal, keeled lamellae of c.3.5mm long, terminating in the upper part of the mid-lobe. *Column* with a short foot, clavate, truncate, c.6.5mm long. *Fruit* ovoid, ridged, c.1.5cm long.

Bhutan: C – Thimphu district (Paro Chu); **Sikkim** (Lachen Valley). In dappled shade and open meadows, open grazed *Abies/Picea/Betula* forest; 2500–4500m. Fl. June–July.

GENERAL DISTRIBUTION. NW Himalaya, Nepal.

ETYMOLOGY. From the Latin *foliosus* (leafy); of significance when the species was placed in the genus *Corallorhiza*.

1b. var. **indica** (Lindl.) N. Pearce & P.J. Cribb in J. Orchid Soc. India 10(1–2): 5 (1996); Edinb. J. Bot. 54(3): 307 (1997). Types: India, W Himalaya, Simla, on Hattu, *Thomson* 1724 (syn. K-LINDL!); Garhwal, *Edgeworth* 1844 (syn. K-LINDL!).

Corallorhiza indica Lindl. in J. Proc. Linn. Soc., Bot. 3: 26 (1859).

Oreorchis indica (Lindl.) Hook. f., Fl. Brit. India 5(2): 709 (1890).

Plant 16–32cm tall. *Pseudobulb* corm-like, 1–1.3 × 1–1.3cm. *Scape* 11–28cm tall, lower part enclosed by tubular sheaths; sheaths 2, 3–6cm long. *Leaf* 1 from pseudobulb apex, oblong-lanceolate, acuminate, 8–12 × 1–2.5cm; petiole 2–4cm long. *Inflorescence* laxly up to 7-flowered; rachis 4–5.5cm long; floral bracts lanceolate, acuminate, 4–8mm long. *Flowers* c.1cm long, purple to pink, blotched with reddish-purple, lip white with purple spots; pedicel and ovary 0.6–1.3cm long. *Dorsal sepal* elliptic-obovate, acute, strongly veined, 0.6–1 × 0.2–0.3cm; *lateral sepals* deflexed, elliptic-lanceolate, falcate, acute, strongly veined, 0.6–1cm long. *Petals* broadly elliptic, obtuse, falcate, strongly veined, 0.6–1cm long. *Lip* adnate to column foot, broadly 3-lobed to unlobed, clawed, strongly veined, 6–8.5 × 4–5.3mm (across lateral lobes); lateral lobes variable, broad, oblong, obtuse to auricular or absent; mid-lobe suborbicular, c.4mm wide, margins undulate, apex retuse; disc lacking a callus. *Column* with a short foot, curved, clavate, truncate, c.7mm long. *Fruit* ovoid, ridged, pendent, c.1.5cm long. **Plate 8.**

Bhutan: C – Ha/Thimphu (Chelai La (field record)), Thimphu (S of Barshong, Dotena, Shanosam), Thimphu/Punakha (Dochu La), Tongsa (Chendebi) and Bumthang (Nakhang) districts; N – Upper Mo Chu district (Chamsa, Kohina, between Gasa Dzong and Laya); **Sikkim** (Lachen Valley); **Chumbi** (Yatung). On cliff faces, in *Picea/Tsuga* forest, dappled shade and open meadows; 2500–4500m. Fl. June–August; Fr. May.

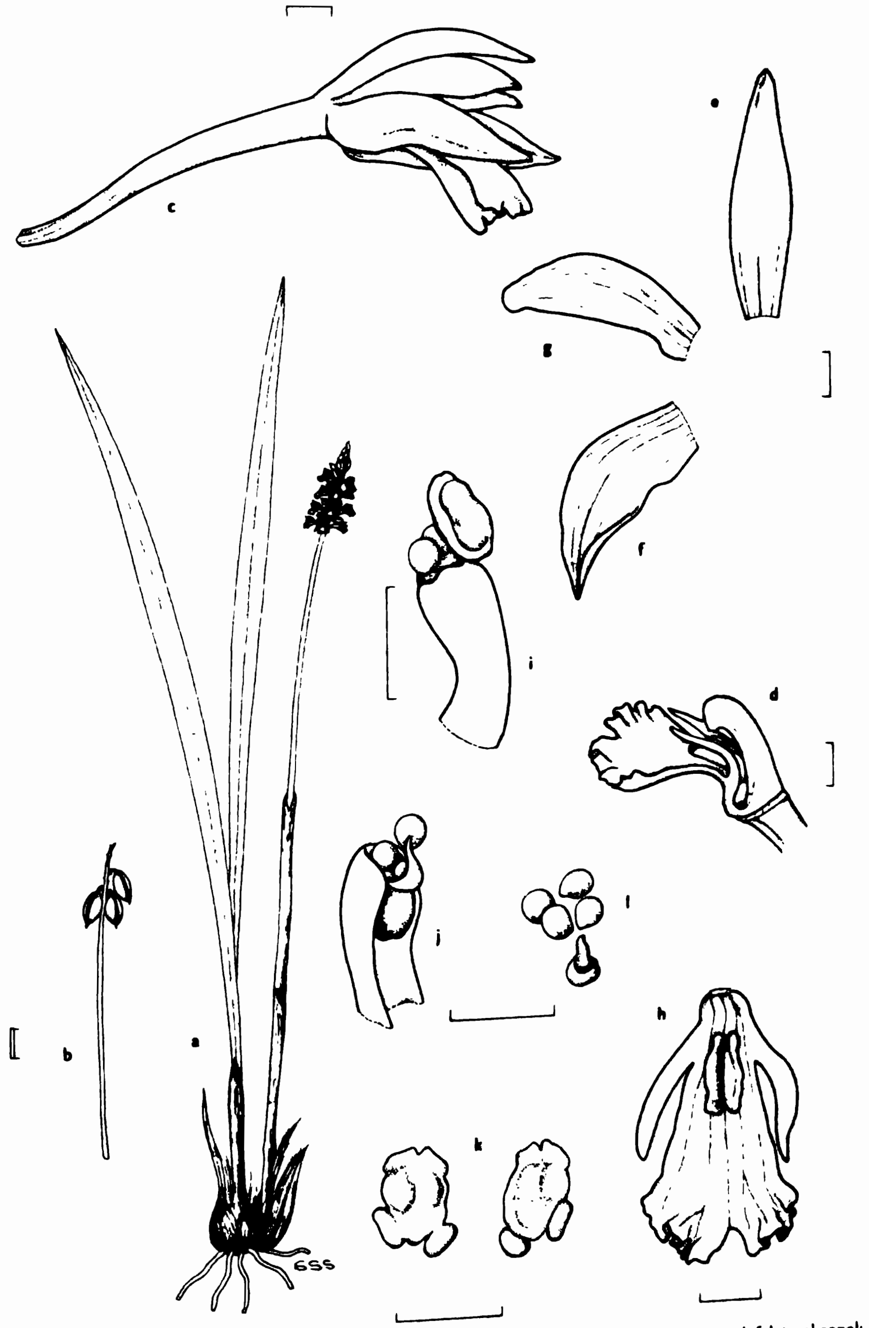


Fig. 55. **Oreorchis micrantha**: a, habit; b, infructescence; c, flower; d, lip and column; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column (back view); j, column (front view); k, anther cap (two views); l, pollinarium. Drawn by Susanna Stuart-Smith, a–b from *Thomson* 214 (K); c–l from *Barclay & Synge* 2654 (K).

GENERAL DISTRIBUTION. India (Himalayas), China (including Xizang) and Nepal.
ETYMOLOGY. From the Latin *indicus* (belonging to India).
NOTE. Pearce & Cribb (1997) reviewed the taxonomic position of this variety.

2. O. micrantha Lindl. in J. Proc. Linn. Soc., Bot. 3: 27 (1859). Type: India, NW Himalaya, Kamaon, Yakul mountains, *Thomson* 214 (holo. K-LINDL!).
Oreorchis rolfei Duthie in J. Asiat. Soc. Bengal 71: 38 (1902). Type: India, W Himalaya, Tehri-Garhwal, Nág Tiba, *P.W. Mackinnon* s.n. (holo. CAL!).
O. foliosa sensu Stewart, Fl. W. Pak. 73 (1972), *non* (Lindl.) Lindl.

Plant 27–35cm tall; roots fleshy, with fibrous strands. *Pseudobulb* corm-like, 1–2 × 1–1.5cm. *Scape* 24–30cm tall, lower half enclosed by tubular sheaths; sheaths 1 or 2, 3–9cm long. *Leaves* 2, from pseudobulb apex, long-linear, acuminate, 20–28 × 0.4–0.7cm. *Inflorescence* dense to subdense; rachis 2–6cm long; floral bracts lanceolate, acute, 2–4mm long. *Flowers* c.6mm long; sepals and petals pale yellow spotted with purple, lip white spotted with purple; pedicel and ovary 0.5–1cm long. *Dorsal sepal* oblong-elliptic, acute, 5-veined, 4–6 × 1–1.5mm; *lateral sepals* elliptic-lanceolate, acute, 5-veined, 3–5 × 1–2mm. *Petals* oblong-elliptic, acute, 5-veined, 4–5.5 × 1–1.5mm. Lip adnate to column foot, clawed, saccate at base, 3–5 × 1.5–2.5mm; lateral lobes long-linear, c.2mm long; mid-lobe suborbicular to elliptic, c.3.5 × 2.5mm; disc with an ovate to linear elevated channelled fleshy callus. *Column* extended into a foot, curved, truncate, c.3mm long. *Fruit* pendent, ridged, c.1.5 × 6mm. Fig. 55; **Plate 8.**

Bhutan: C – Thimphu (Chelai La (field record), Drugye Dzong) and Tongsa (Chendebi, E side of Shing Jakpa La) districts; **N** – Upper Mo Chu district (Gasa Dzong, between Tamji and Gasa); **Darjeeling** (Sandakphu to Tonglu, below Tiger Hill summit); **Sikkim** (Damthang to Gangtok, Lachen Valley). On damp banks under trees, under bamboo and in wet pine, spruce, oak and rhododendron forest; 2300–3100m. Fl. June–July; Fr. May.

GENERAL DISTRIBUTION. India (Himalayas), Nepal, China (Xizang) and Myanmar.
ETYMOLOGY. From the Greek *micro-* (small) and *anthos* (flower) in reference to the size of the flowers as compared with *O. foliosa*.

3. O. sanguinea (N. Pearce & P.J. Cribb) N. Pearce & P.J. Cribb, **comb. nov.** Type: Bhutan, Thimphu district, below Talukah Gompa (Tataka), above Simtokha, *J.R.I. Wood* 6403 (holo. E!).
Aphyllorchis sanguinea N. Pearce & P.J. Cribb in Edinb. J. Bot. 56(2): 273 (1999).

Plant leafless (at time of collection). *Pseudobulbs* (not seen). *Stem* stout, woody, glabrous, ridged towards apex, c.23.5 × 0.4cm, tapering to c.1.5mm at apex; sheaths 2 appressed, clasping, 4.5–5cm long. *Inflorescence* laxly 10-flowered; rachis tapering towards apex, c.9cm long; floral bracts lanceolate-oblong, acute, 2.5–4mm long. *Flowers* 1.1–1.5cm across, dark red; pedicel and ovary c.1.5cm long. *Dorsal sepal* elliptic-lanceolate, acute, 5-veined, 1.1 × 0.26cm; *lateral sepals* broadly elliptic-lanceolate, falcate, acute, 0.85–1.2 × 0.2–0.3cm. *Petals* broadly oblanceolate, obtuse, weakly falcate, 7-veined, 9 × 3mm. *Lip* clawed, entire, veined, 6.5–9 × 6mm (at base, when spread); claw c.1.5 × 2mm; base simple, widening to midpoint; mid-lobe broadly 2-lobed, orbicular; central disc with 2 short, crescent-shaped calluses, c.1.75mm long. *Column* curved, anther terminal, 5–6.5mm long. *Fruit* twisted, ridged, 1.2–1.6cm long. **Fig. 7a–j.**

Bhutan: C – Thimphu district (below Tataka above Simotkha). On grassy tracksides in shady moist mixed forest; 2800m. Fl. June.

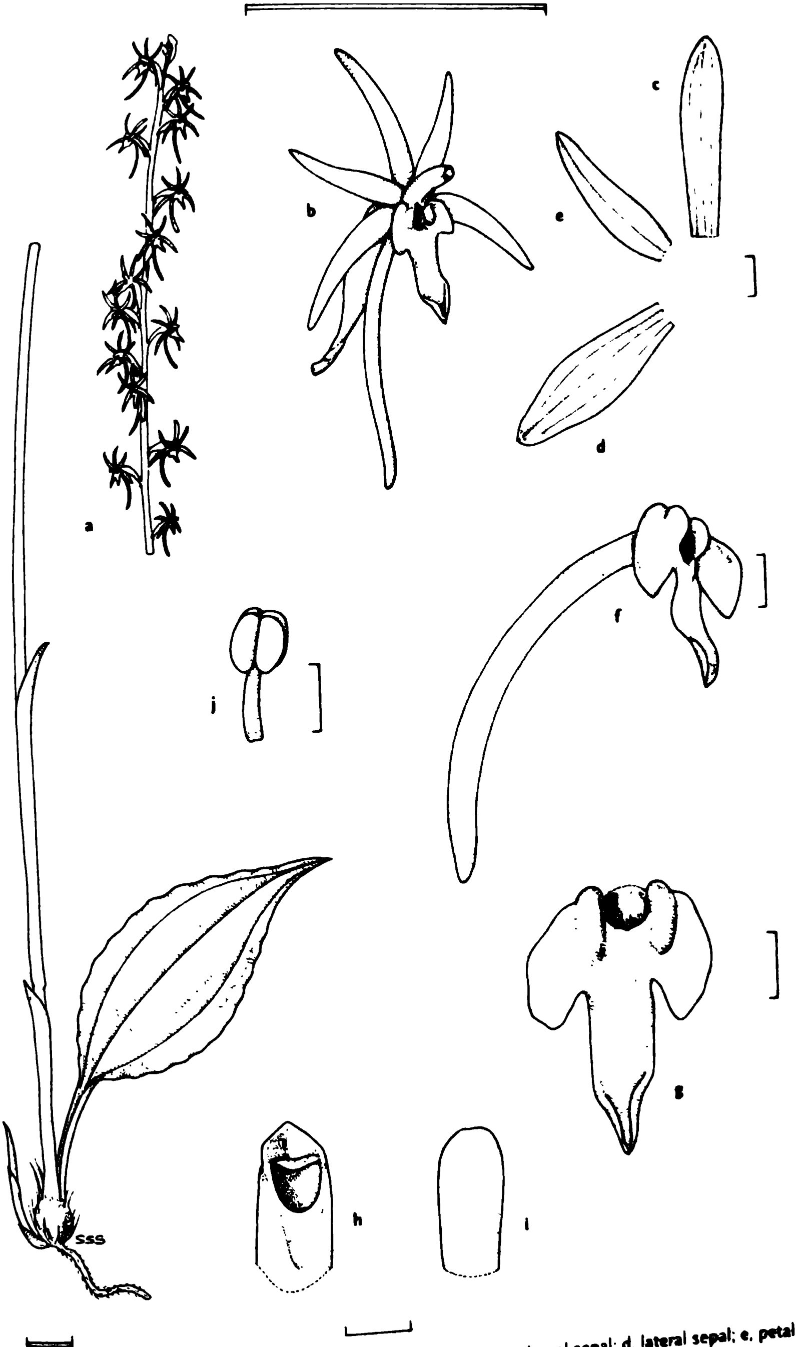


Fig. 56. **Tipularia josephi**: a, habit (inflorescence detached); b, flower; c, dorsal sepal; d, lateral sepal; e, petal; f, lip and spur; g, lip; h, column apex (front view); i, column apex (back view); j, pollinarium. Drawn by Susanna Stuart-Smith a–i from *Hooker* 351 (K); j from illustrations in King & Pantling (1898).

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *sanguineus* (blood red), referring to the flower colour.
NOTES. *Aphyllorchis sanguinea* was described by Pearce & Cribb based on a specimen collected in Bhutan. Garay (pers. comm.) and Ormerod (pers. comm.) have pointed out to us that the plant correctly belongs within *Oreorchis*. Its status within *Oreorchis*, however, remains a problem. It is related to *O. nepalensis* N. Pearce & P.J. Cribb which differs in having sepals and petals that are brown-green to yellow-green, linear-oblong petals and a 3-lobed lip with a claw that does not widen medially. It is also related to *O. porphyranthes* Tuyama which differs in having 2–5 flowers, a subquadrate, 3-lobed lip which is unclawed, with a basal callus. We transfer it to *Oreorchis* here, but realise that further collections are required before we can be certain of its status.

55. **Tipularia** Nuttall

Plants terrestrial. *Pseudobulbs* small. *Leaf* solitary, petiolate. *Inflorescence* arising from base of pseudobulb, erect, slender, laxly racemose. *Flowers* small. *Sepals* and *petals* subequal, lanceolate, spreading. *Lip* long-spurred, curved forwards; lateral lobes rounded, each bearing a callus; mid-lobe ovate-lanceolate, deflexed. *Column* broad, straight, wingless; anther terminal, depressed; pollinia 4.

The genus *Tipularia* was established in 1818 by Thomas Nuttall (1786–1859) in the *Genera of North American plants*. The genus comprises three disjunct species found in N America, the Himalayas, China and Japan.

The North American species, *T. discolor* (Pursh) Nuttall, is the only member of the genus with flowers with modified bilateral symmetry, which probably represents an evolutionary advantage over the usual bilateral symmetry. Pollination of this species, by Noctuid moths, has been examined by Stoutamire (1978). The asymmetric column enables the flowers to attach the pollinaria away from the midline of the visiting insects, thereby avoiding the scaly areas, and allowing secure attachment, usually to the eyes.

TYPE. *Tipularia discolor* (Pursh) Nuttall; basionym: *Orchis discolor* Pursh.
ETYMOLOGY. From a resemblance of the flower to insects of the genus Tipula (Craneflies).

1. **T. josephi** Rchb. f. ex Lindl. in J. Proc. Linn. Soc., Bot. 1: 174 (1857). Type: India, Sikkim, Hooker 351 (holo. K-LINDL!).

Plant 24–38cm tall. *Pseudobulbs* subglobose, c.1cm wide. *Leaf* broadly ovate, acute, margins undulate, base rounded, abruptly petiolate, plicate, 5- to 7-veined, 5–9 × 2.5–5cm; petiole 2–3cm long. *Inflorescence* laxly 12- to 28-flowered; peduncle bracteolate, 15–23cm long; rachis 5–15cm long; floral bracts broadly triangular, c.0.5mm long. *Flowers* 5–8mm wide, colour not known; pedicel and ovary 4–7mm long. *Sepals* and *petals* similar, lanceolate, acute, spreading, 3–5 × 0.6–1.5mm. Lip 3-lobed, spurred, constricted in the middle, c.4 × 1.5mm; lateral lobes ovate, pointed, with a thick, oblong callus; mid-lobe elliptic, acuminate, with an oblong callus at base; spur curved, c.6mm long. *Column* straight, 1–1.5mm long. **Fig. 56.**

Bhutan: N – Upper Mo Chu district (between Gasa and Chamsa); **Sikkim** (Lachen, Lachung Valley, Singalila). 2800–4000m. Fl. May–July.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and China.
ETYMOLOGY. Named after Joseph Dalton Hooker (1817–1911) who collected the type specimen.
NOTE. *T. josephi* has a strikingly long spur for the size of the flower.

56. **Yoania** Maximowicz

Plants mycotrophic, terrestrial, leafless; *rhizomes* stout, branched, lacking roots. *Stem* erect, stout, bearing a few short sheaths. *Inflorescence* terminal, racemose. *Flowers* sub-campanulate, fleshy. *Sepals* and

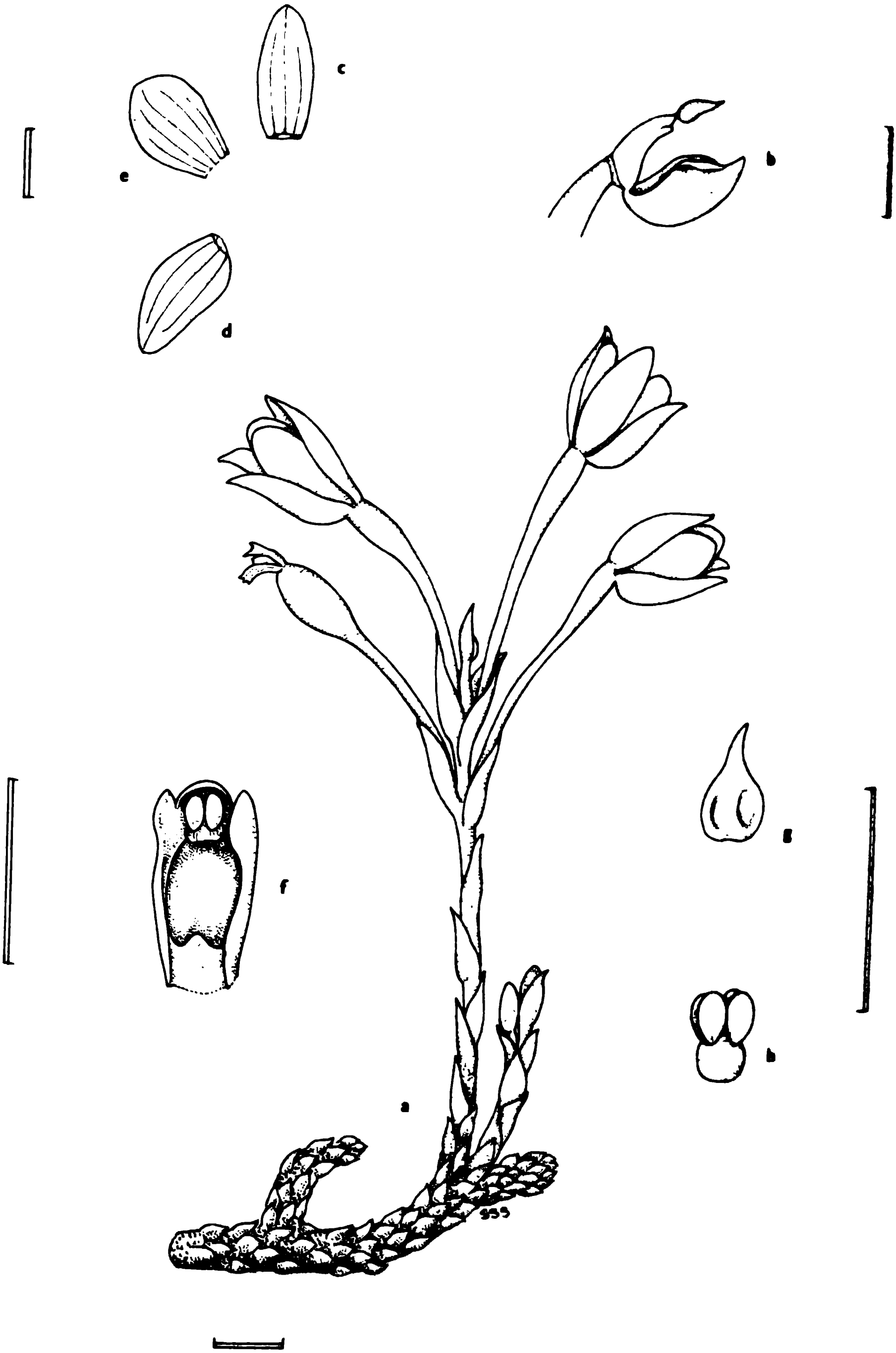


Fig. 57. **Yoania prainii**: a, habit; b, lip, column and ovary; c, dorsal sepal; d, lateral sepal; e, petal; f, column; g, anther cap; h, pollinarium. Drawn by Susanna Stuart-Smith from *Pantling* 469 (K).

petals similar, short, concave, fleshy. *Lip* sessile, adnate to column foot, slipper-shaped or saccate; spurred or not. *Column* stout, broad, dentate at apex, winged; stigma transverse, concave; pollinia 4 (2 deeply cleft), waxy, sessile on large, quadrate viscidium.

The genus *Yoania* was described in 1872 by Carl Maximowicz (1827–1891), a Russian botanist and explorer, in the *Bulletin de l'Académie Impériale des Sciences de St.-Pétersbourg*. The genus comprises three species distributed in NE India, Japan and Australia.

TYPE. *Yoania japonica* Maximowicz.
ETYMOLOGY. Named after Dr Wudogawa Yoan, Japanese botanist, physician and botanical artist.

1. **Y. prainii** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 175, t.237 (1898). Types: India, Sikkim, Choongthang (Chunthang), *Pantling* 469 (syn. BM! CAL K!); Naga Hills, *Prain* 15 (syn. CAL K!).

Plant 7–13cm tall; *rhizome* densely clothed with small, overlapping, narrowly lanceolate, acuminate, appressed scales. *Stem* glabrous; sheaths 2 or 3, loose, 0.7–1 × 0.3–0.4cm. *Inflorescence* laxly 3- or 4-flowered; floral bracts ovate, fleshy, 7–9 × 3–5mm. *Flowers* c.1.5 × 1.5cm, white; pedicel and ovary 2–4cm long. *Sepals* similar, ovate-lanceolate, subacute, 3-veined, 1.2–1.8 × 0.4–0.8cm. *Petals* ovate-orbicular, obtuse, entire, 5-veined, 1–1.6 × 0.4–0.8cm. *Lip* entire, spurless, 1.5–2cm long. *Column* stout; anther anticous, broad, beaked, c.9mm long. *Fruit* fusiform, 5–6cm long. **Fig. 57.**

Sikkim (Chunthang). In soft leaf-mould; 2000m. Fl. July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after Sir David Prain (1857–1944), the British botanist who collected one of the type specimens.
NOTES. King & Pantling (1898) noted that this species differed from the related *Y. japonica* Maximowicz in that the lip had entire margins, and was spurless and anadorned. Hooker (1890) had reported *Y. japonica* from the Naga Hills but King & Pantling corrected this misidentification.

Chen & Tsi (1999) proposed a new subtribe Yoaniinae S.C. Chen & Z.H. Tsi for this genus.

Tribe **Cymbidieae** Pfitzer

Subtribe **Eulophiinae** Bentham

57. **Eulophia** R. Br. ex Lindl.

Plants small, medium or large, terrestrial, autotrophic or rarely mycotrophic; *roots* slender to stout, often with velamen. *Pseudobulbs* variable, borne below or above ground, several-noded. *Leaves* present at flowering or developing later, green, one to many, thin, fleshy or coriaceous, lanceolate, ovate, or elliptic; in mycotrophic species reduced to brownish scales. *Inflorescence* erect, lateral, racemose or sometimes paniculate, laxly to subdensely many-flowered. *Flowers* small to large, often showy. *Sepals* and *petals* similar, free to base (lateral sepals sometimes fused to the column foot). *Lip* 3-lobed, spurred or not at base; usually with a callus on upper surface. *Column* short to long, ± winged; column foot present or absent; anther cap entire or 2-lobed; pollinia 2, subglobose; stipes solitary; viscidium oblong, elliptic or lunate.

The genus *Eulophia* was established in 1823 by John Lindley in the *Botanical Register*. This spelling has been conserved over *Eulophus* (proposed by Robert Brown in the *Botanical Register* in 1821) and over *Eulophia* Agardh. The genus comprises about 250 species widespread in the tropical Americas, tropical and southern Africa, Madagascar, the Mascarenes, tropical and subtropical Asia and Australasia.

Kullenberg (1961) reported pollination in the African species E. *horsfallii* (Bateman) Summerhayes by carpenter bees of the genus *Xylocopa*. Lock & Profita (1975) reported pollination of E. *cristata* (Sw.) Steudel, another African species, by the large carpenter bee *Xylocopa olivacea* - the bee seems to be attracted by the flower shape and colour as there are no known floral rewards.

Hooker (1890) proposed a sectional treatment based upon the presence or absence of a column foot and we follow this here.

TYPE. *Eulophia guineensis* Lindl., *typ. cons.*
ETYMOLOGY. From the Greek *eu-* (well-developed) and *lophos* (crest) in reference to the prominent calluses on the lip.

Key to species

1. Column lacking a prominent foot 2
+ Column with a prominent foot 7

2. Leaves present during flowering 3
+ Leaves absent during flowering 4

3. Spur of lip wide, conical; leaves linear .... **4. E. mannii**
+ Spur of lip narrow, geniculate; leaves elliptic .... **5. E. promensis**

4. Inflorescence paniculate; apex of mid-lobe with long filiform processes .... **3. E. graminea**
+ Inflorescence not paniculate; apex of mid-lobe setose or papillose-warty 5

5. Flowers less than 1cm across; spur of lip abruptly clavate at apex; peduncle slender, less than 3mm wide .... **6. E. stenopetala**
+ Flowers greater than 1cm across; spur of lip not abruptly clavate; peduncle stout, more than 3mm thick 6

6. Spur slender, linear-curved; disc setose-papillose .... **1. E. dabia**
+ Spur broad at base, conical; disc warty-papillose .... **2. E. densiflora**

7. Leaves present during flowering .... **8. E. spectabilis**
+ Leaves absent during flowering 8

8. Autotrophic; flowers pale yellow-green; less than 1.5cm long .... **7. E. bicallosa**
+ Mycotrophic; flowers red-brown; more than 1.5cm long .... **9. E. zollingeri**

Section **Eulophia**

1. **E. dabia** (D. Don) Hochreutiner in Bull. NewYork Bot. Gard. 6: 270 (1910). Type: Nepal, *Buchanan-Hamilton* s.n. (holo. BM!, iso. LINN! Herb. no. 1402.6).
Limodorum dubium Buchanan-Hamilton mss. *nom. nud.*
Bletia dabia D. Don, Prodr. Fl. Nepal: 30 (1825).
Limodorum ramentaceum Roxb., Fl. Ind. ed. 1832, 3: 467 (1832). Type: India, Bengal, [icon. of] 'Limodorum ramentaceum' Roxburgh 2344 (holo. CAL, iso. K!).
Dipodium ramentaceum Buchanan-Hamilton in Wall. Cat.: 7370 (1832), *nom. nud.*
Eulophia campestris Lindl., Gen. Sp. Orchid. Pl.: 185 (1833). Types: India, Oudh, coll. *Wallich* Wall. Cat. 7367 (syn. K-LINDL!, isosyn. K-W!); Himalayas, *Royle* 44 (syn. LIV!).
E. ramentacea (Roxb.) Lindl., *loc. cit.* (1833). Type: India, Bihar, Dhonidoha, coll. *Buchanan-Hamilton* Wall. Cat. 7370 (holo. K-W!).
E. rupestris Lindl., *loc. cit.* (1833). Type: Nepal, coll. *Wallich* Wall. Cat. 7368 (holo.K-LINDL!, iso. K-W!).
Geodorum ramentaceum (Lindl.) Voigt, Hort. Suburb. Calcutt.: 628 (1845).
Eulophia hemileuca Lindl. in J. Proc. Linn. Soc., Bot. 3: 25 (1859). Type: India, Rohilcund, *Thomson* 219 (holo. K-LINDL!).

Graphorchis campestris (Lindl.) Kuntze, Revis. Gen. Pl. 2: 662 (1891).
G. dubia (D. Don) Kuntze, loc. cit. (1891).
Eulophia faberi Rolfe in Bull. Misc. Inform. Kew 1896: 198 (1896). Types: China, Chekiang, *Faber* s.n. (syn. K!); Szechuan (Sichuan), *Henry* s.n. (syn. K!).
Limodorum turkestanicum Litvinov in Trudy Bot. Muz. Imp. Akad. Nauk. 1: 18 (1902). Type from Kazakhstan.
Eulophia hormusjii Duthie in Ann. Roy. Bot. Gard. (Calcutta) 9(2): 125, t.125 (1906). Type: India, Dehra Dun, *Mackinnon* 22708 (holo. K).
E. turkestanica (Litvinov) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 12: 374 (1913).

Plant 18–35cm tall. *Pseudobulbs* irregular, cylindric-globose, 0.5–2 × 0.5–1.2cm; *roots* fleshy, clustered. *Scape* leafless during flowering, 10–27cm tall; sheaths lanceolate-oblong, acute to acuminate, appressed, 1–3cm long. *Leaves* 2, absent during flowering, linear, acute, plicate, 25–30 × 0.3–0.7cm. *Inflorescence* racemose, terminal, subsecund, laxly to subdensely flowered; rachis 3–19cm long; floral bracts erect, pale brown, oblong to oblong-lanceolate, acute to acuminate, 3-veined, 0.6–1.5 × 0.1–0.3cm. *Flowers* erect to pendent (after fertilisation), 0.7–1.7cm long, pale pink to maroon, with darker mauve-purple veins, lip flushed with yellow; pedicel and ovary slender, 1–2cm long. *Sepals* similar, spreading, narrowly oblong, acute, entire, 5-veined, glabrous, 5–8 × 2–3mm. *Petals* linear-oblong, acute, 5–8 × 2–3mm. *Lip* 3-lobed, spurred, 7–9 × 4–6mm; lateral lobes connivent with column, obtuse, 4–5mm long; mid-lobe orbicular-quadrate, margins crenulate-dentate, surface warty, shortly setose, 3–4 × 2–4mm; *spur* narrow, obtuse, 2–5 × 0.3–0.5mm. *Column* erect, clavate, anther terminal, c.4 × 2mm (at apex). *Fruit* pendent, oblong-ovoid, 1.8–2.2 × 0.4–1cm.

Bhutan: S – Phuntsholing district (Phuntsholing, at base of the Torsa River); C – Punakha (Gon Chungnang, between Punakha and Tinlegang) and Mongar (between Lhuntse Dzong and Kuru Chu) districts; (unlocalised *Griffith* specimen); **Terai** (unlocalised *Pantling* specimen); **Duars** (Buxa Reserve, Chekopara, Dunichi?, Singtam). Frequent in fixed sand ridges, dry open mountainside; 400–1330m. Fl. January–May.

GENERAL DISTRIBUTION. Afghanistan, Pakistan, N India, Myanmar and China.
ETYMOLOGY. Obscure, see note below.
NOTES. The type of this species is a Buchanan-Hamilton collection from Nepal. Lindley stated that he had seen a drawing in Bauer's collection labelled *Limodorum dubium*. Don, however, when he published the species in the genus *Bletia* believed the original spelling of the epithet to have been '*dabia*'. Hooker and Kuntze followed Lindley and used the spelling 'dubium', considering Don's spelling to have been an orthographic error. Hochreutiner transferred the species to *Eulophia* as *E. dabia* and this has been followed by Santapau & Kapadia (1961) and most other recent authors. Although the etymology of *dabia* is obscure, Seidenfaden (1988, unpublished) felt that retaining Don's spelling would avoid confusion, even though this spelling is probably an orthographic error.

King & Pantling's (1898) illustration (t.241) of *E. campestris* Lindl. (*E. dabia* (D.Don) Hochreutiner) shows long filiform processes from the apex of the disc. The plants we have examined do not exhibit this character, the disc being warty or shortly setose.

2. **E. densiflora** Lindl. in J. Proc. Linn. Soc., Bot. 3: 25 (1859). Type: Bhutan, *Griffith* 6 (holo. K-LINDL!).
Cyrtopera densiflora (Lindl.) Rchb. f., Otia Bot. Hamburg. 1: 68 (1878).
Graphorchis densiflora (Lindl.) Kuntze, Revis. Gen. Pl. 2: 662 (1891).

Plant 60–90cm tall. *Leaves* absent during flowering (none seen in specimens examined). *Inflorescence* terminal, racemose, subsecund, laxly to subdensely 9- to many-flowered; peduncle stout, woody, 3–7mm wide, bearing sheaths; sheaths 3 or 4, lanceolate, acute to acuminate, 2–4cm long; rachis 11–16cm long; floral bracts linear-lanceolate, acuminate, 1.5–2 × 0.2–0.3cm. *Flowers* erect to subpendent, 2.5–3cm long; pedicel and ovary 1.5–2cm long. *Sepals* similar, oblong to oblong-elliptic, acute, 5-veined, 2–3 × 0.3–0.4cm. *Petals* oblong, acute, 5-veined, 2–3 × 0.3–0.3cm. *Lip* 3-lobed, spurred, 2–2.6mm long; lateral lobes broadly oblong, erect, rounded apex, 1.2–1.6cm long; mid-lobe clawed in lower third, orbicular, margins crenate, vein papillose, 5–8mm wide; spur short, wide, obtuse, 3–4 × 1.5–2mm. *Column* winged, c.8mm long.

Bhutan: (unlocalised *Griffith* specimens); **Sikkim**: (unlocalised *Hooker* specimen).

GENERAL DISTRIBUTION. E Himalaya.

ETYMOLOGY. From the Latin *densus* (crowded, dense) and *-flora* (flowered), in reference to the inflorescence.

NOTES. *E. densiflora* was first described by Lindley and included in his leafless group. It is closely related to *E. dabia* but differs in having a more conical spur. The description above is based on the Griffith type specimen.

3. **E. graminea** Lindl., Gen. Sp. Orchid. Pl.: 182 (1833). Type: Singapore (Singapur), coll. *Wallich* Wall. Cat. 7372C (holo. K-LINDL!, iso. K-W!).

Graphorchis graminea (Lindl.) Kuntze, Revis. Gen. Pl. 2: 662 (1891).

Satyrium zeylanicum König in Trimen, Handb. Fl. Ceylon 4: 176 (1898), nom. nud.

Eulophia gusukumai Masamune in Trans. Nat. Hist. Soc. Taiwan 24: 208 (1934). Type from Taiwan.

E. ucbii Malhotra & Balodi in Bull. Bot. Surv. India 26(1–2): 92 (1984). Type: India, Pithorgarh, *Bipin Balodi* 75561 (holo. CAL, iso. BSD).

Plant 40–70cm tall; *roots* thick, clustered. *Pseudobulbs* ovoid, 1–5 × 0.8–2cm. *Leaves* 4–6, absent during flowering, suberect, linear-lanceolate, acute, 10–30 × 0.5–1cm. *Inflorescence* slender, erect, racemose or paniculate, laxly many-flowered; peduncle sheathed, 25–35cm long; sheaths 3 or 4, lanceolate, acute, clasping, 0.8–3cm long, borne 7–11cm apart; rachis 13–28cm long; floral bracts linear-lanceolate, acuminate, 4–8 × 1–2mm. *Flowers* 1–2cm long, greenish, with brown-purple veins, lip white with pinkish-purple markings; pedicel and ovary filiform, 1.5–2cm long. *Sepals* and *petals* similar, spreading, linear-lanceolate, 0.8–1.2 × 0.15–0.25cm. *Lip* 3-lobed, spurred, 1–1.5 × 0.3–0.7cm; spur basal, clavate, 2–4mm long; lateral lobes erect, enfolding the column, ovate-triangular, obtuse; mid-lobe porrect, suborbicular, undulate; disc central, with 3 to 5 parallel keels, becoming long-filiform-papillose in the mid-lobe. *Column* erect, straight, expanded towards apex, c.6 × 2mm (at apex); pollinia 2, c.1mm across. *Fruit* pendent, 1.5–2 × 0.5–1cm. **Fig. 58.**

Bhutan: C – Mongar district (Khinay Lhakang, Lhuntse Dzong to Kuru Chu); **Duars** (unlocalised *Pantling* specimen); **Sikkim** (Sembri). On dry, open mountainside, on river banks; 300–2000m. Fl. March–April.

GENERAL DISTRIBUTION. India, Myanmar, China, Thailand, SE Asia, the Ryukyu Islands, Malaysia and Sumatra.

ETYMOLOGY. From the Latin *gramineus* (grass-like) in reference to the leaves.

NOTES. Pradhan (1979) included *E. graminea* in the synonymy of *E. epidendraea*. Seidenfaden (1983, 1995b) discussed this question of conspecificity and concluded, with some doubt, that on the basis of the difference in the floral dimensions it was preferable to maintain the two species as distinct. We remain very uncertain about the validity of the distinction, but follow his treatment until the position is clarified by a complete monograph.

4. **E. mannii** (Rchb. f.) Hook. f., Fl. Brit. India 6(1): 4 (1890); Icon. Pl. ser.4(22): t.2115 (1894). Types: India, Upper Assam, *Mann* 6 (syn. K!); Assam, *Mann* 12 (syn. W!); Assam, *Mann* 22 (syn. W!).

Cyrtopera mannii Rchb. f. in Flora 55: 274 (1872).

Graphorchis mannii (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 662 (1891).

Plant erect, tall, 1–1.75 m. *Pseudobulbs* rhizomatous, fleshy, transversely fusiform, 3–5 × 1.5–3.5cm; *roots* few, slender, white. *Leaves* 2, present during flowering, linear, acuminate to

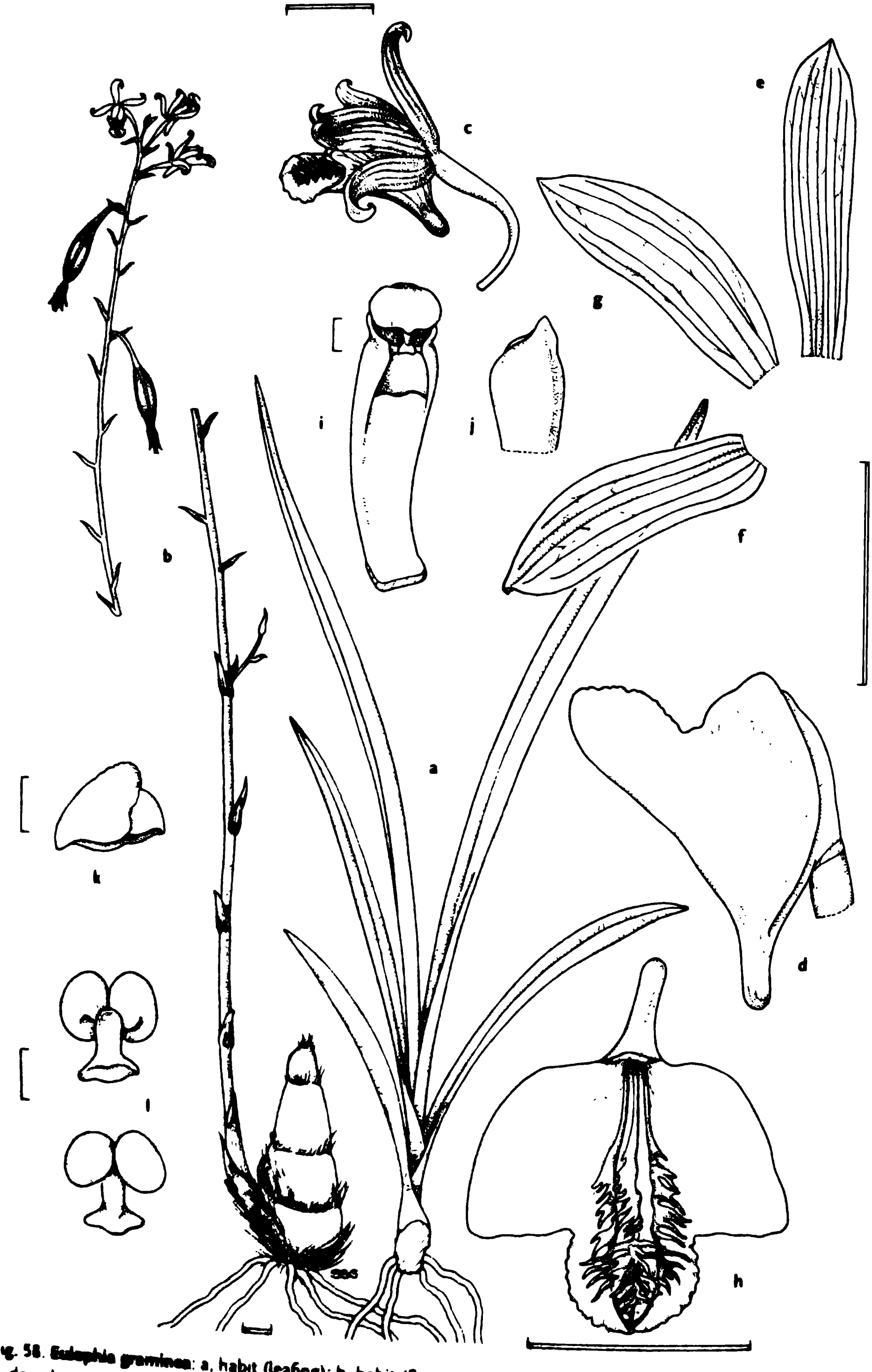


Fig. 58. **Eulophia graminea**: a, habit (leafing); b, habit (flowering); c, flower; d, lip and column (side view); e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column; j, column apex (back view); k, anther cap; l, pollinarium (two views). Drawn by Susanna Stuart-Smith, a–b from *Pantling* 438 (K); c–m from *Ludlow et al.* 20148 (K).

linear-lanceolate, 3-veined, 80–90 × 1.5–2.5cm. *Inflorescence* axillary, racemose, 9- to 15-flowered; peduncle sheathed, 35–40 × c.2cm (wide at base); sheaths greenish, 11–32cm long; rachis 10–17cm long; floral bracts oblanceolate, acute, 0.6–1 × 0.1–0.25cm. *Flowers* c.2.2 × 2–4cm, uniformly yellow to yellowish-green; pedicel and ovary greenish, c.2cm long. *Dorsal sepal* oblanceolate, acute, 9-veined, 1.8–2 × 0.7–1cm; *lateral sepals* oblanceolate, acute, subequal, adnate to column, c.1.8 × 0.7cm. *Petals* broadly obovate, 11-veined, 1.2–1.7 × 0.8–1cm. *Lip* broadly 3-lobed, saccate at base, spurred, 10- or 11-veined, 1.6–2cm long; lateral lobes erect, rounded; mid-lobe orbicular, margins crenate-undulate; disc with thickened veins with a warty callus; *spur* obtuse, 3–4mm long. *Column* broad, foot short, c.2mm long.

Sikkim (unlocalised *Pantling* specimen). In tropical valleys. Fl. June–August.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named after Gustav Mann (1836–1916), who between 1863 and 1891 worked for the Indian Forest Service, and collected the type specimen in Assam.

NOTE. Reported by Rao & Hajra (1974) from Assam and Sikkim, and by Pradhan (1979) from Sikkim and Darjeeling.

5. **E. promensis** Lindl., Gen. Sp. Orchid. Pl.: 181 (1833). Type: Myanmar (Burma), Pegu, Prome Hills, coll. *Wallich* Wall. Cat. 7365 (holo. K-W!).

Tainia promensis (Lindl.) Hook. f., Icon. Pl. n.s.9: t.1883 (1883); Fl. Brit. India 5(2): 820 (1890).

Eulophia geniculata King & Pantling in Journ. As. Soc. Bengal 64(2): 327 (1895). Type: India, Darjeeling, Rungeet (Rangit) Valley, *Pantling* 282 (holo. K!).

Ascotainia promensis (Lindl.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 246 (1919).

Eulophia massiei Guillaumin in Bull. Soc. Bot. France 77: 338 (1930). Type from Laos.

Ania promensis (Lindl.) Senghas in Schltr., Orchid. ed.3(1): 863 (1984).

Plant 50–100cm tall. *Pseudobulbs* tuberous, cylindric-globose, 1.5–2cm long. *Leaves* 2, present during flowering, large, narrowly elliptic, acute, plicate, long petiolate, blade c.60cm long; petiole c.50–60cm long. *Inflorescence* terminal, racemose, laxly 6- to 8-flowered; peduncle sheathed, ridged, c.40cm long; sheaths 2–7cm long; rachis c.14cm long; floral bracts linear-lanceolate, acute, c.2 × 0.1cm. *Flowers* 1–2cm across; sepals brown, petals and lip pale yellow; pedicel and ovary long-linear, 2–2.5cm long. *Sepals* subsimilar, c.1.5 × 0.5cm; *dorsal sepal* elliptic, obtuse; *lateral sepals* elliptic-lanceolate, subacute. *Petals* broadly oblong, obtuse, adnate to the column base. *Lip* oblong, spurred, c.1.5 × 0.5mm; lateral lobes long, narrow; mid-lobe broad oblong-elliptic, apex truncate, with 3–5 parallel thickened veins ending towards apex in a warty area; *spur* geniculate, 4–5 × 1–2mm. *Column* broad, lacking a foot, c.8mm long.

Darjeeling (Rangit Reserved Forest). 330m. Fl. August–September.

GENERAL DISTRIBUTION. NE India, Myanmar, Thailand and Laos.

ETYMOLOGY. From the Prome Hills in the Pegu region of Burma.

NOTES. Lindley described E. *promensis* based on a collection by Wallich from Burma; Hooker later (1890) transferred the species to *Tainia*. Turner (1992) was uncertain that this transfer was correct and was unsure about its generic placement. Ormerod (pers. comm.) examined the type of E. *promensis* (at K-W), believed it to be correctly placed in *Eulophia* and considered it to be conspecific with E. *geniculata*. The former has priority and Thomas (1998) reduced E. *geniculata* to its synonymy.

6. **E. stenopetala** Lindl. in J. Proc. Linn. Soc., Bot. 3: 26 (1859). Type: Bhutan, Panukka (Punakha), *Griffith* 847 (holo. K-LINDL!).

Eulophia sp. 847 Griffith, Itin. Pl. Khasyah Mts.: 164 (1848), *sine nom*.

Graphorchis stenopetala (Lindl.) Kuntze, Revis. Gen. Pl. 2: 662 (1891).

Plant 30–50cm tall. *Pseudobulbs* irregular, c.1cm tall. *Scape* erect, ridged, 20–35cm tall; sheaths clasping, distant, ovate-lanceolate, acute to acuminate, 1.5–2.5cm long. *Leaves* 2, linear, plicate, c.30 ×

0.3cm. *Inflorescence* terminal, racemose, laxly 5- to 8-flowered; rachis 2–6cm long; floral bracts lanceolate, acuminate, 1–1.4 × 0.2–0.3cm. *Flowers* c.1cm long, purple with darker purple veins, lip apex brownish; pedicel and ovary long-linear, 1.2–1.5cm long. *Sepals* similar, linear-oblong, acute, 5-veined, 0.9–1.1 × 0.2–0.3cm. *Petals* narrowly oblong, veined, 0.9–1.1 × 0.2–0.3cm. Lip 3-lobed, spurred, c.9 × 4mm; lateral lobes oblong, obtuse; mid-lobe elliptic-orbicular, margins crenulate, with 3 small, 3-dentate calluses on veins; spur clavate at apex, 4–5 × c.1mm. Column erect, clavate, c.3mm long.

Bhutan: C – Punakha district (Punakha, near Tinlegang). On dry hills; 1800m. Fl. May.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. From the Greek *steno-* (narrow) and *petalon* (petal).

NOTE. This species is characterised by its clavate spur.

Section **Cyrtopera** Hook. f., Fl. Brit. India 6(1): 5 (1890).

7. **E. bicallosa** (D. Don) P.F. Hunt & Summerhayes in Kew Bull. 20: 60 (1966). Type: Nepal, *Buchanan-Hamilton* s.n. (holo. BM!, iso. LINN! Herb. no. 1402.8).

Bletia bicallosa D. Don, Prodr. Fl. Nepal.: 30 (1825).

Limodorum bicallosum Buchanan-Hamilton ex D. Don, loc. cit. (1825), nom. nud.

Cyrtopera bicarinata Lindl., Gen. Sp. Orchid. Pl.: 190 (1833). Type: Mayanmar (Burma), Pabgong, coll. *Buchanan-Hamilton* Wall. Cat. 7363 (holo. K-LINDL!).

C. candida Lindl. in J. Proc. Linn. Soc., Bot. 3: 31 (1859), **syn. nov**. Lectoype (selected here): India, Sikkim, [inflorescence from] *Hooker* 241 (lecto. K-LINDL!, isolecto. K!).

Eulophia candida (Lindl.) Hook. f., loc. cit. (1890), **syn.nov.**

Graphorchis candida (Lindl.) Kuntze, loc. cit. (1891), **syn. nov.**

Eulophia bicarinata var. *major* King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 181, t.244A (1898). Type: India, Sikkim, *Pantling* 436 (holo. CAL, iso. BM! W!).

E. bicallosa var. *major* (King & Pantling) Pradhan, Indian Orch.: Guide Identif. Cult. 2: 461 (1979).

Plant 50–70cm tall. *Pseudobulbs* tuberous-rhizomatous, cylindric, irregular, compressed, 5–10cm long. *Leaf* 1, linear to linear-lanceolate, acuminate, plicate, sheathing at base, 20–40 × 0.5–1cm; petiole 15–30cm long; sheaths 3, lanceolate, acute, 4–10cm long. *Inflorescence* racemose, terminal, laxly few- to 20-flowered; peduncle grooved, sheathed, 40–50cm tall; sheaths 2 or 3, lanceolate-ovate, acute, borne c.13cm apart; rachis 12–17cm long; floral bracts lanceolate, acuminate, 0.5–1 × 0.15–0.2cm (at base). *Flowers* ± spreading, 2–3cm across, pale yellowish-green with purple-red stippling or veining; pedicel and ovary linear, pubescent, 1–1.5cm long. *Sepals* subsimilar, oblong, acute, keeled, margins reflexed; *dorsal sepal* 1–1.5 × 0.26–0.35cm; *lateral sepals* adnate at base to column foot, 1.3–1.9 × 0.35–0.5cm. *Petals* narrowly elliptic, subacute, weakly porrect, margin undulate, 1–1.5 × 0.5–0.6cm. Lip 3-lobed; lateral lobes obliquely crescentic to triangular, 2–3 × 7–9mm; mid-lobe clawed at base, broadly ovate, truncate-emarginate when spread 0.6–0.8 × 0.7–1cm; disc with 3–5 parallel, warty ridges; spur subconical, obtuse, c.3 × 1mm. *Column* slender, curved, c.6mm long; foot long, at right-angles to column, c.3mm long; pollinia broadly triangular; anther beaked, broad.

Terai (Choklong); **Duars** (unlocalised *Pantling* specimen); **Sikkim** (unlocalised *Hooker* specimen). c.200m. Fl. February–March.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, Thailand, Taiwan, Sumatra, New Guinea and Australia.

ETYMOLOGY. From the Latin *bi-* (two) and *callosus* (a hardened thickening, callus) in reference to the raised callus ridges on the disc.

NOTES. King & Pantling (1898) described var. *major*, distinguishing it by being a larger plant and having a dense cluster of callosities in front of the lamellae. We have examined the type material and here treat it as a synomym within this variable taxon.

E. candida (Lindl.) Hook. f. was based upon a Hooker collection from Sikkim and a drawing by Cathcart. Hooker (1890) pointed out that the Cathcart drawing was of *E. nuda* Lindl. (now *E. spectabilis* (Dennstedt) Suresh) and considered that the plant might be a variety of *E. bicarinata* (Lindl.) Hook. f., (*E. bicallosa* (D. Don) P.F. Hunt & Summerhayes). Examination of the type material shows that the leaves belong to *Tainia latifolia* (Lindl.) Rchb. f., the inflorescence to *Eulophia bicallosa* and the drawing to *E. spectabilis*. We therefore reduce this species to synonymy here and designate a lectotype.

An extended synonymy can be found in Thomas (1998).

8. E. spectabilis (Dennstedt) Suresh in Regnum Veg. 119: 300 (1988). Lectotype: India, Malabar coast, *Rheede* s.n. (based on Rheede's 'ela-pola' in Hort. Malab. 11: 71, t.36 (1692)!, designated by Suresh in Nicolson, Suresh & Manilal, Interp. Van Rheede's Hort. Malab.).

Wolfia spectabilis Dennstedt, Schlüssel Hortus Malab.: 11, 25, 38 (1818).

Eulophia nuda Lindl., Gen. Sp. Orchid. Pl.: 180 (1833). Type: Nepal, Mt. Morang, coll. *Buchanan-Hamilton* Wall. Cat. 7371 (holo. K-W!).

Cyrtopera plicata Lindl., *op. cit.* 190 (1833). Type: Nepal, Mt. Morang, coll. *Buchanan-Hamilton* Wall. Cat. 7362 (holo. K-LINDL!, iso. K-W!).

Eulophia bicolor Dalzell in Hooker's J. Bot. Kew Gard. Misc. 3: 343 (1851). Type: India, Amberkund, *Dalzell* s.n. (holo. K!).

Cyrtopera fusca Wight, Icon. Pl. Ind. Orient. 5: 1690 (1852). Type: India, Nilgiri Hills, *Wight* s.n. (holo. K!).

C. mysorensis Lindl. in J. Proc. Linn. Soc., Bot. 3: 32 (1859). Type: India, Mysore, *Law* 56 (holo. K-LINDL!).

C. gardneri Thwaites, Enum. Pl. Zeyl.: 302 (1864). Type from Sri Lanka.

C. laxiflora Gardner ex Thwaites, *loc. cit.* (1864). Type from Sri Lanka.

Eulophia holochila Collett & Hemsley in J. Linn. Soc., Bot. 28: 132 (1890). Type: Myanmar (Burma), *Collett* 767 (holo. K!).

Phaius steppicolus Handel-Mazzetti in Anz. Akad. Wiss. Wien. Math.-Naturwiss. Kl. 62: 253 (1925). Type: China, Guizhou, *Handel-Mazzetti* 10392 (holo. WU).

Plant erect 35–60cm tall. *Pseudobulbs* subterranean, enclosed by several lanceolate sheaths, 1.5–2 × 1.5–3cm. *Leaves* 3 or 4, present during flowering, oblong-lanceolate to lanceolate-ovate, acuminate, plicate, petiolate, 13–30 × 1–5cm; petiole 6–10cm. *Inflorescence* laxly few- to many-flowered; peduncle fleshy, sheathed, 30–70cm long; sheaths several, ovate-elliptic, acute to acuminate, 2–6cm long; rachis 10–25cm long; floral bracts linear-lanceolate, acuminate, 1–1.5cm long. *Flowers* 2.5–3cm across; sepals olive-green with darker green or maroon veins, petals creamy with pink veins, lip pale mauve-green to white, spur pale green, column pink; pedicel and ovary slender, 2–2.5cm long. *Sepals* subsimilar, spreading, acute to acuminate; *dorsal sepal* narrowly oblong-elliptic, 1.5–2 × 0.4–0.5cm; *lateral sepals* obliquely oblong-elliptic, falcate, adnate to column foot, 2.2–2.5 × 0.6–0.7cm (at base). *Petals* ovate-elliptic, obtuse to acute, reflexed at apex, 1.7–2 × 0.7–0.9cm. *Lip* obscurely 3-lobed, ovate-oblong, fleshy, c.1.8 × 1.4cm; lateral lobes obscure, rounded; mid-lobe obtuse, margin crenulate, veins minutely papillose, c.0.8 × 1cm; *spur* conical, obtuse, pointing down between divergent halves of column foot, 0.6–0.8 × 0.5–0.6cm. *Column* narrowly winged below, 0.9–1 × 0.4–0.5cm; foot long, curved.

Bhutan: C – Punakha (Wangdi Phodrang to Samtengang) and Mongar (between Lhuntse Dzong and Kuru Chu) districts; **Terai** (unlocalised Hooker specimen); **Darjeeling** (Rangit); **Sikkim** (unlocalised *Pantling* specimen). 660–2390m. Fl. April–July.

GENERAL DISTRIBUTION. From India, Sri Lanka, the Himalayas, China, Indo-China, Malaysia, Indonesia, the Philippines, New Guinea to Fiji and Tonga.

ETYMOLOGY. From the Latin *spectabilis* (remarkable) probably a reference to the large flowers.
NOTE. A full synonymy can be found in Thomas (1998).

9. E. zollingeri (Rchb. f.) J.J. Smith, Orch. Java: 228 (1905). Type: Java, Lampong Province and Gabbok Klakka, *Zollinger* 585 (holo. W!).
Cyrtopera zollingeri Rchb. f. in Bonplandia 5: 38 (1857). Type from Java.
C. sanguinea Lindl. in J. Proc. Linn. Soc., Bot. 3: 32 (1859). Types: India, Sikkim, Himalaya, *Hooker* 223 (syn. K-LINDL!); Sikkim, *Hooker* 361 (syn. K-LINDL!).
Eulophia macrorhiza Bl., Coll. Orchid.: 155, t.63, f.2 (1859). Type from Java.
Cyrtopera rufa Thwaites, Enum. Pl. Zeyl.: 302 (1861). Type from Sri Lanka.
Cyrtopodium rufum (Thwaites) Trimen, Syst. Cat. Fl. Pl. Ceylon: 89 (1885).
Cyrtopera papuana Ridley in J. Bot. 24: 354 (1886). Type from Papua New Guinea.
Eulophia macrorhizon Hook. f., Fl. Brit. India 6(1): 7 (1890). Type: Ryana, *King* s.n. (holo. CAL).
E. sanguinea (Lindl.) Hook. f., op. cit. 8 (1890).
Graphorchis rufa (Thwaites) Kuntze, Revis. Gen. Pl. 2: 662 (1891).
G. sanguinea (Lindl.) Kuntze, loc. cit. (1891).
Eulophia papuana (Ridley) J.J. Smith in Nova Guinea 8: 26 (1909).
E. macrorhiza var. *papuana* (Ridley) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 417 (1912).
E. ochobiensis Hayata, Icon. Pl. Formos. 6: 78 (1916). Type from Taiwan.
E. carrii C.T. White in Proc. Roy. Soc. Queensland 47: 82 (1936). Type from Australia.
E. yushuiana S.Y. Hu in Chung Chi J. 11(1): 19 (1972). Type: China, Hong Kong, *S.Y. Hu* 10274 (holo. A).

Plant mycotrophic, leafless, 50–80cm tall. *Pseudobulbs* subterranean, tuberous, rhizomatous, 3–12 × 1.5–3cm; *roots* worm-like, thick. *Inflorescence* racemose, terminal, laxly 6- to 25-flowered; peduncle erect, broad, sheathed, 40–50 × 0.4–0.8cm; sheaths 2–4, lanceolate-ovate, acuminate, weakly clasping, 3–5.5cm long; rachis 10–19cm long; floral bracts linear-lanceolate, flexuous 1–2 × 0.1–0.2cm. *Flowers* 2–3.5cm across, dull purple-red to brown, column green-yellow; pedicel and ovary linear, weakly curved, 1.5–2.5cm long. *Dorsal sepal* erect, ovate-lanceolate, acuminate, 2–2.5 × 0.6–0.9cm; *lateral sepals* obliquely ovate, acuminate, adnate to column foot, spreading, 2–2.5 × 0.6–0.9cm. *Petals* obovate, spreading, minutely notched, apiculate, 1.5–2 × 0.5–0.8cm. *Lip* 3-lobed, saccate, 1.6–1.7cm long; lateral lobes small, obtuse, c.4mm long; mid-lobe small, broadly ovate, recurved, apiculate, margins undulate, veins weakly papillose, 6–7 × c.6mm; disc with 2 central lamellae; *spur* broad, saccate, c.3mm deep. *Column* long, winged at apex, c.8mm long; column foot c.3mm long; anther cap ovate, retuse. *Fruit* ellipsoid, pendent, c.6cm long.

Darjeeling (Mongpu, Pul Bazar, Rayeng Reserved Forest, Rayong N). In secondary forest, in leaf litter, in shade; 500–1500m. Fl. May.

GENERAL DISTRIBUTION. India, Sri Lanka, Japan, Thailand, Malaysia, Indonesia, the Philippines, New Guinea and Australia (Queensland).
ETYMOLOGY. Named after Heinrich Zollinger (1818–1859) who collected the type specimen.

Doubtfully recorded and imperfectly known species.

E. macrobulbon (Parish & Rchb. f.) Hook. f., Fl. Brit. India 6(1): 7 (1890). Type: Myanmar (Burma), Moulmein, *Parish* 37 (holo. K!).
Cyrtopera macrobulbon Parish & Rchb. f. in Trans. Linn. Soc. London 30: 144 (1874).
Eulophia cambodiensis Guillaumin in Bull. Soc. Bot. France 77: 337 (1930). Type from Cambodia.

NOTES. Hooker (1890) referred to a drawing of this species in Calcutta based on a plant from Sikkim. Although Pradhan (1979) and Bose & Bhattacharjee (1980) recorded it from Sikkim Seidenfaden (1983) knew of no other record from the Himalayan region and considered these reports to be doubtful.

58. Geodorum Jackson

Plants terrestrial. *Pseudobulbs* globose, fleshy, arising at, or just below, soil surface, sheathed when young. *Leaves* terminal, few, plicate, broad, petiolate. *Inflorescence* racemose, arising laterally from pseudobulb, crozier-like when flowering, erect in fruit, separate from the leaf-bearing stem, densely several- to many-flowered. *Flowers* not opening widely, campanulate. *Sepals* and *petals* similar, free. *Lip* entire to obscurely 3-lobed; base shortly saccate, not spurred, usually with an obscure, ridged callus. Column short, with a distinct foot; pollinia 2; stipe and viscidium distinct.

The genus *Geodorum* was described in 1811 by J. Jackson in the *Botanist's Repository*. The genus comprises about 10 species, widespread from India, through SE Asia to Australia and the islands of the SW Pacific.

The genus is taxonomically difficult and species delimitation has presented many, as yet unresolved, problems. Seidenfaden (1983) reviewed the problems without resolving them and felt that the position would only be clarified by a full monographic revision.

TYPE. *Geodorum citrinum* Jackson.
ETYMOLOGY. From the Greek *geo-* (earth) and *doron* (gift).

1. **G. densiflorum** (Lamarck) Schltr. in Feddes Repert. Sp. Nov. Regni Veg. Beih. 4: 259 (1919). Lectotype based on Rheede's 'béla-póla' in Hort. Malab. 11: 65, t.35 (1692)!, designated by Seidenfaden in Opera Bot. 72: 61 (1983).
Limodorum densiflorum Lamarck, Encycl. 3: 516 (1792).
L. nutans Roxb., Pl. Coromandel 1: 33, t.40 (1795). Type: India, [icon. of] '*Limodorum nutans*' Roxburgh 240 (holo. CAL, iso. K!).
Malaxis cernua Willdenow, Sp. Pl., ed.4(1): 93 (1805). Type based on 'béla-póla' in Rheede, Hort. Malab. 11: t.35 (1692)!

M. nutans (Roxb.) Willdenow, loc. cit. (1805).
Cymbidium pictum R. Br., Prodr. 1: 331 (1810), *nom. alt.*
Geodorum purpureum R. Br. in Aiton, Hortus Kew. ed.2(5): 207 (1813), *nom. alt.*
Otandra cernua (Willdenow) Salisbury, Trans. Hort. Soc. 1: 298 (1812).
Cistella cernua (Willdenow) Bl., Bijdr. 7: 293 (1825), *nom. tantum?*
Geodorum pictum (R. Br.) Lindl., Gen. Sp. Orchid. Pl.: 175 (1833).
Ortmannia cernua (Willdenow) Opiz, Flora 17: 592 (1834).
Geodorum fucatum Lindl. in Bot. Reg. 20: t.1687 (1835). Type from Sri Lanka.
G. semicristatum Lindl., Fol. Orchid. Geodorum 6: 2, no.7 (1854). Type from the Philippines.
G. pacificum Rolfe in Inform. Bull. Misc. Inform. Kew 1908: 71 (1908). Types from Tonga and the Solomon Islands.
G. neocaledonicum Kränzlin in Vierteljahrsschr. Naturf. Ges. Zürich 74: 82 (1929). Type from New Caledonia.

Plant 25–50cm tall. *Pseudobulb* subglobose, enclosed by scarious sheaths. *Leaves* 2–4, fasciculate, plicate, suberect, lanceolate, lanceolate-elliptic, or oblong-elliptic, acute to acuminate, petiolate, blade 16–35 × 3.5–9.5cm; petiole 6–27cm long. *Inflorescence* usually shorter than the leaves, compact, subglobose, pendent, many-flowered; peduncle erect, sheathed, 18–25cm long; rachis c.2cm long; floral bracts linear-lanceolate, acuminate, 0.6–1 × c.0.15cm (at base). *Flowers* 0.8–1cm long, white to pale green with yellow and purple markings; ovary 0.4–1cm long. *Sepals* and *petals* similar, gaping, linear-oblong, oblanceolate-oblong to ovate-elliptic, acute to obtuse, 5- to 7-veined, 0.8–1.2 × 0.3–0.4cm. *Lip* boat-shaped, 6–7 × 4–6mm (when spread at base); base weakly saccate with lateral lobes folded over; apex obscurely 2-lobed, with rounded lobes, margins weakly undulate; disc with 2 or

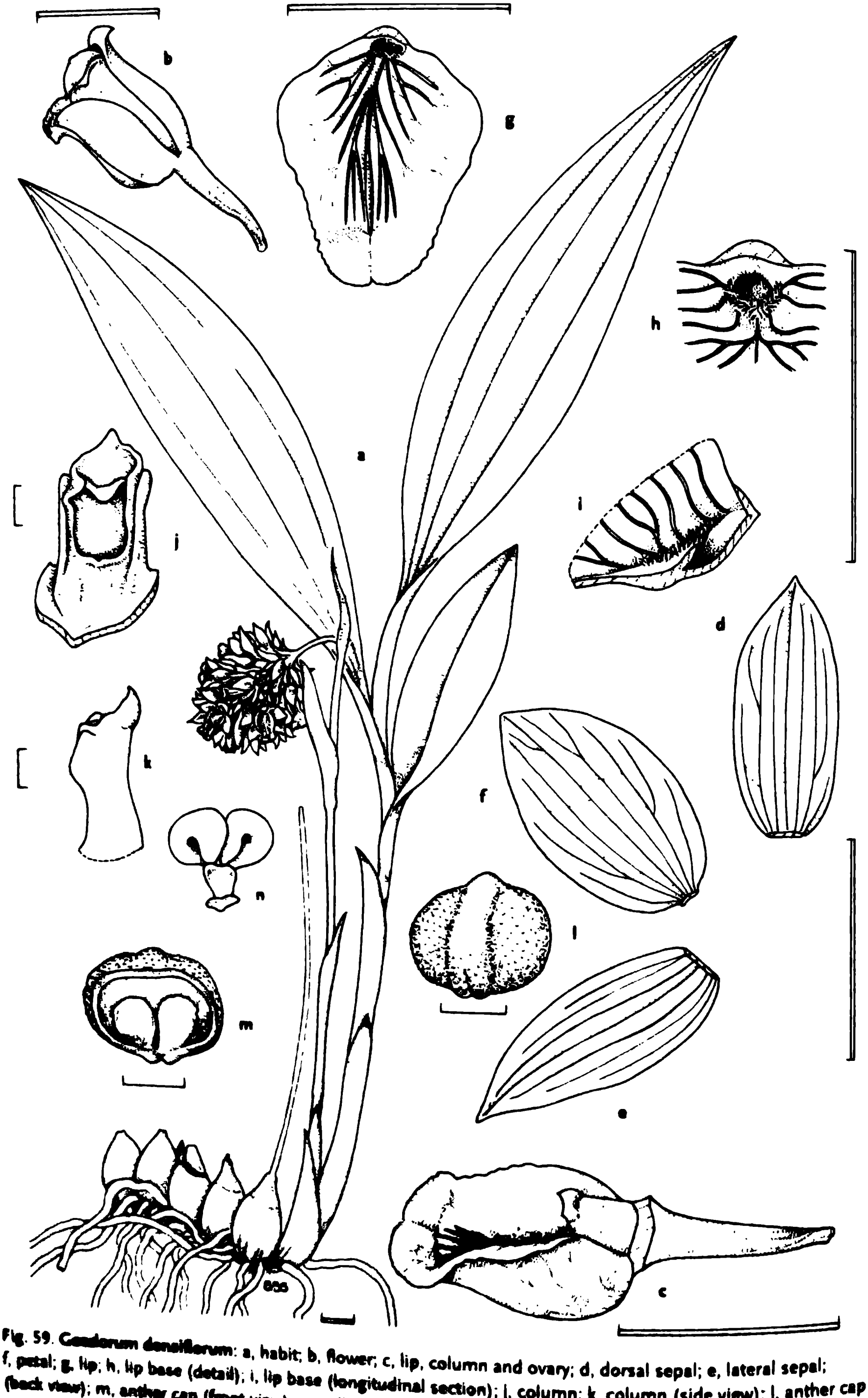


Fig. 59. **Geodorum densiflorum**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip base (detail); i, lip base (longitudinal section); j, column; k, column (side view); l, anther cap (back view); m, anther cap (front view); n, pollinarium. Drawn by Susanna Stuart-Smith from *Kurzweil* 260 (K).

3 wart-like, tubercular, ridged calluses. *Column* weakly curved, with a foot, c.3mm long. *Fruit* pendent, c.3 × 1.5cm. Fig. 59.

Terai (unlocalised *Clarke* specimen); **Darjeeling** (10km S of Kalimpong, Tista River, near the Coronation Bridge); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). In undisturbed monsoon forest; 200–1000m. Fl. April–July.

GENERAL DISTRIBUTION. India, S and SE Asia, Malaysia, Taiwan, the Ryukyu Islands, the Philippines and Pacific Islands.

ETYMOLOGY. From the Latin *densus* (crowded, dense) and *florus* (flowered).

NOTES. Seidenfaden (1983) discussed the complex taxonomic and nomenclatural problems of this species. He treated *G. densiflorum* and *G. recurvum* as separate species based on their differing flowering times and lip features. He did not come to a conclusion about the status of *G. purpureum*. Garay & Sweet (1974), Pradhan (1979) and Deva & Naithani (1986) treated *G. purpureum* within the synonymy of *G. densiflorum*. The available herbarium material makes a firm conclusion difficult. However, all the material from our area examined by us shows plants with a lip that agrees with Rheede's 'bela-póla'. The Roxburgh plate (no.40) of *Limodorum nutans* has an acute, undivided lip apex but otherwise agrees with Rheede's plant and this was the position taken by Roxburgh in *Flora Indica*, where he noted that the two plants (*L. recurvum* and *L. nutans*) flowered at the same time of year. Hooker (1890) felt that the acute lip was 'due to infolding of the margins towards the apex' and redescribed it retaining the name *G. purpureum*. We feel, based upon the material from our area, that *G. purpureum* is probably conspecific with *G. densiflorum* and treat it as such here but leave *G. recurvum* as a separate species based upon the Roxburgh plate (no. 39) which shows an expanded, oblong, undulate lip apex. A full monographic treatment will be required to resolve these problems.

Dockrill (1992) treated the Australian species *G. pictum* within the synonymy of *G. densiflorum*, and we follow this here.

Doubtfully recorded and imperfectly known species

G. recurvum (Roxb.) Alston in Trimen, Handb. Fl. Ceylon 6: 276 (1931). Type: India, Deccan, Circars, [icon. of] '*Limodorum recurvum*' Roxburgh 239 (holo. CAL, iso. K!).
Limodorum recurvum Roxb., Pl. Coromandel: 33 (1795).
Geodorum dilatatum R. Br. in Aiton, Hortus Kew. ed.2(5): 207 (1813).

NOTE. We have not seen any specimens of this species from our area but since Seidenfaden (1982) treated it as a separate species flowering in April and May, and his drawings suggests a close resemblance to plants that are found in our area, we maintain it as a separate species until its taxonomic position is clarified.

Subtribe **Cyrtopodiinae** Bentham

59. **Cymbidium** Sw.

Plants epiphytic, lithophytic or terrestrial, usually autotrophic, rarely mycotrophic (when lacking leaves); *roots* caespitose. *Pseudobulbs* short to elongate, covered by bladeless sheaths. *Leaves* long, oblong or rarely lanceolate, coriaceous. *Inflorescence* erect or curved, suberect or pendent, racemose, 1- to many-flowered; peduncle loosely sheathed. *Flowers* often large and showy. *Sepals* and *petals* free, spreading or erect. *Lip* 3-lobed, sessile, borne on a short column foot; lateral lobes erect around the column; mid-lobe recurved; disc with 1–3, glabrous or pubescent, ridges. *Column* long; pollinia 2 (with deep grooves) or 4, subglobose or pyramidal, attached by a short caudicle to a broad viscidium.

The genus *Cymbidium* was described in 1799 by Olof Swartz (1760–1818) in *Nova Acta Regiae Societatis Scientiarum Upsaliensis*. However, his generic delimitation was broad and only two of his species are now considered to belong to the genus. Various taxonomists (including Schlechter, 1924) helped to clarify the taxonomy of the genus, which has recently been revised by Du Puy & Cribb who give a thorough synonymy (Du Puy & Cribb, 1988a). The genus comprises about 50 species distributed in India, east through SE Asia, China, Japan, Indonesia to Australia.

Kjellson, Rasmussen & Du Puy (1985) examined the pollination of *Cymbidium insigne* Rolfe and *Dendrobium infundibulum* Rchb. f. in Thailand. They found that pollination was by the bumble-bee *Bombus eximius* Smith, which also pollinated *Rhododendron lyi* Léveillé. *Rhododendron lyi* contains abundant nectar but the orchids offer no reward and they proposed a three-way floral mimicry based on deceit. Ridley (1896) reported that *Cymbidium aloifolium* (L.) Sw. was visited, and fertilised, by the hornet *Vespa cincta* Fabr. and by Carpenter bees of the genus *Xylocopa*.

Lawler (1984) stated that the rhizomes of *C. macrorhizon* were used medicinally in N India as a diaphoretic (an agent inducing perspiration) and as a febrifuge (a medicine to reduce fever), and to treat boils. The flowers of *C. longifolium* and *C. hookerianum* are used to flavour curries in C and E Bhutan.

TYPE. *Cymbidium aloifolium* (L.) Sw.; basionym: *Epidendrum aloifolium* L.
ETYMOLOGY. From the Greek *cymbi-* (a boat), a reference to the shape of the lip.

Key to species

1. Margin of lip fused to base of the column for 2–6mm, forming a short sac 2
+ Lip free, attached to base of the column or column foot 9

2. Callus wedge-shaped at apex; inflorescence usually 1-flowered .... **8. C. eburneum**
+ Callus in 2 parallel ridges, not wedge-shaped at apex; inflorescence usually more than 1-flowered 3

3. Lip white, with numerous fine maroon spots; callus with strongly inflated and confluent ridges at apex .... **12. C. whiteae**
+ Lip and callus not as above 4

4. Flowers pendent, campanulate 5
+ Flowers erect, not campanulate 6

5. Flowers greenish-brown; lip red-spotted; leaves less than 1cm wide .... **10. C. cochleare**
+ Flowers yellowish-cream; lip usually unspotted; leaves more than 1.4cm wide **11. C. longifolium**

6. Inflorescence axillary from the leaves; leaf apex 2-lobed, forked .... **9. C. mastersii**
+ Inflorescence arising from base of pseudobulb; leaf apex acute 7

7. Lip white with sparse, irregular, red-brown spots; flowers less than 5cm across; dorsal sepal less than 1.1cm wide .... **5. C. erythraeum**
+ Lip strongly marked with red or red-brown spots; flowers more than 5cm across; dorsal sepal more than 1.2cm wide 8

8. Sepals and petals clear green; flowering February to March; callus on lip pubescent **6. C. hookerianum**
+ Sepals and petals marked with red-brown; flowering October to November; callus on lip long-ciliate .... **7. C. iridioides**

9. Callus ridges strongly convergent in apical half, forming a short tube at base of the mid-lobe 10
+ Callus ridges not as above 15

10. Plant mycotrophic, leafless .... **18. C. macrorhizon**
+ Plant autotrophic, with green leaves 11

11. Leaves elliptic, petiolate; pseudobulbs fusiform; inflorescence arising from middle of pseudobulb .... **17. C. lancifolium**
+ Leaves linear-elliptic, lacking a distinct petiole; pseudobulbs ovoid or inconspicuous; inflorescence arising from base of pseudobulb 12

12. Leaves 2–4 from each pseudobulb .... **13. C. munronianum**
+ Leaves 5–10 from each pseudobulb 13

13. Mid-lobe of lip covered with glistening, inflated papillae; mid-lobe margins minutely fimbriate and strongly undulate .... **15. C. faberi** var. **szechuanicum**
+ Mid-lobe of lip minutely papillose or with few inflated papillae; mid-lobe margins entire or weakly undulate 14

14. Inflorescence more than 1-flowered; leaf 0.9–1.5cm wide; lip pale green with red-purple streaks .... **14. C. cyperifolium** subsp. **cyperifolium**
+ Inflorescence 1-flowered; leaf less than 0.9cm wide; lip cream with crimson spots .... **16. C. goeringii** var. **goeringii**

15. Callus ridges reduced to 2 small swellings at base of mid-lobe of the lip .... **4. C. devonianum**
+ Callus ridges not as above 16

16. Callus ridges entire, straight .... **3. C. dayanum**
+ Callus ridges S-shaped, often broken in the middle 17

17. Lateral lobes of lip exceeding the column, veined with maroon .... **1. C. aloifolium**
+ Lateral lobes of lip not exceeding the column, finely mottled with maroon or red .... **2. C. bicolor** subsp. **obtusum**

Section **Cymbidium**

1. C. aloifolium (L.) Sw. in Nova Acta Regiae Soc. Sci. Upsal. 6: 73 (1799). Lectotype: based on Rheede's 'kansijram-maravara' in Hort. Malab. 12: 17, t.8 (1693)!, designated by Seth in Kew Bull. 37: 399 (1982).
Epidendrum aloifolium L., Sp. Pl. ed.1: 953 (1753).
C. simulans Rolfe in Orch. Rev. 25: 175 (1917). Lectotype: India, Sikkim, *Pantling* 268 (K!) designated by Seth & Cribb in Kew Bull. 37(3): 400 (1982).

Plant epiphytic, 30–90cm tall. *Pseudobulbs* inflated, ovoid, bilaterally flattened, enclosed in persistent leaf bases and bladeless sheaths, 6–9 × 3–4cm. *Leaves* 4–5(–6), oblong, obtuse to emarginate, unequally 2-lobed at apex, coriaceous, arching, jointed, blade 30–100 × 1.5–4.5cm; leaf base 4–18cm long; sheaths 6 or 7, becoming scarious and fibrous with age, 5–14cm long. *Inflorescence* 20- to 45-flowered; peduncle sheathed, 4–14cm long; sheaths 5–7, basal, overlapping, boat-shaped, acute, 3.5–7cm long; rachis 24–76cm long; floral bracts triangular, 2–5mm long. *Flowers* lightly scented, 3.5–4.2cm across; sepals and petals pale yellow-cream, maroon-striped, lip white-cream, base yellow, maroon-veined, callus yellow; pedicel and ovary 1.1–2.5cm long. *Sepals* similar, narrowly oblong to narrowly elliptic, obtuse, mucronate, erect, 1.9–2.4 × 0.5–0.8cm. *Petals* narrowly elliptic, obtuse to acute, sometimes mucronate, porrect, 1.8–2.3 × 0.5–0.8cm. Lip 3-lobed, saccate at base, minutely papillose-pubescent, 1.5–2.3 × 1–1.4cm (when spread); lateral lobes erect, acute to acuminate, porrect, clasping the column; mid-lobe ovate, acute to obtuse, mucronate, recurved, entire, 0.84–1.2 × 0.65–0.9cm; callus with 2 sigmoid ridges. Column curved, winged at apex, 1–1.2cm long; foot short; pollinia 2, cleft. Fruit cylindric-ellipsoid, 4–7 × 2–3cm. **Plate 8.**

Darjeeling (Tista River); **Sikkim** (Tendong, Tista). In tropical valleys, in forks and hollows of large branches, in partial shade; 350–2000m. Fl. April–July.

GENERAL DISTRIBUTION. India, Nepal, S China, Myanmar, Thailand, SE Asia, Malaysia and Java.
ETYMOLOGY. From the Greek *aloe* and Latin *Aloë* (the plant *Aloe vera*, bitter aloes) and the Latin *folium* (leaf), referring to the leaf shape.
NOTE. This species can be distinguished from the closely related *C. bicolor* subsp. *obtusum* by the strongly veined mid- and lateral lobes of the lip and the long acute to acuminate lateral lobes which extend beyond the anther cap.

2. C. bicolor Lindl., Gen. Sp. Orchid. Pl.: 164 (1833). Type: Sri Lanka (Ceylon), *Macrae* 54 (holo. K-LINDL!)

subsp. **obtusum** Du Puy & P.J. Cribb, Genus Cymbidium: 70 (1988). Type: Thailand, Uttaradit, *Menzies & Du Puy* 120 (holo. K!).
Cymbidium crassifolium Lindl., Gen. Sp. Orchid. Pl.: 165 (1833), nom. nud.
C. mannii Rchb. f. in Flora 55: 274 (1872). Type: India, Assam, *Mann* s.n. (holo. W! Herb. no.45878).
C. pendulum sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 188, t.251 (1898), non (Roxb.) Sw.
C. flaccidum Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 12: 109 (1913). Type: China, Szechuan (Sichuan), *Esquirol* 2728 (holo. B†).

Plant epiphytic, 18–60cm tall. *Pseudobulbs* narrowly ovoid, enclosed in persistent leaf bases; bladeless sheaths 4 or 5, becoming scarious-fibrous with age, c.11cm long. *Leaves* 5–7, narrowly oblong, obtuse, stiff, arching, 30–70 × 1.3–3.1cm; leaf base 3–12cm long. *Inflorescence* arching to pendent, 10- to 26-flowered; peduncle short, sheathed, 2–12cm long; sheaths 5, overlapping, boat-shaped, spreading, 3.5–5.5cm long; rachis 8–33cm long; floral bracts triangular, 1.5–4.5mm long. *Flowers* lightly fruit-scented, 2.5–4.5cm across; sepals and petals pale yellow-cream, striped maroon-brown, lip white-cream with a pale yellow patch at base, mottled with maroon to purple brown, callus cream-yellow, column cream; pedicel and ovary 0.9–4.2cm long. *Sepals* similar, narrowly oblong to obovate-oblong, obtuse to subacute, erect to spreading, 1.6–2.1 × 0.4–0.6cm. *Petals* narrowly oblong-elliptic, spreading, 1.5–1.95 × 0.4–0.6cm. Lip 3-lobed, saccate at base, papillose to shortly pubescent, 1.2–1.8 × 0.9–1.5cm (when spread); lateral lobes erect, clasping the column, obtuse, porrect to recurved; mid-lobe broadly elliptic, rounded, mucronate at apex, 5.2–8.7 × 6–9.6mm; callus 2-ridged, entire, minutely papillose-pubescent. *Column* curved, winged at apex, 0.9–1.2cm long; foot short. Fruit cylindric-ellipsoid, 4–6 × 2–3cm.

Bhutan: S – Samchi district (Samchi); **C** – Tashigang district (between Tashigang Dzong and Ghunkarah); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). In tropical and subtropical forest valleys, in the forks and hollows of trees, in partial shade; 330–1000m. Fl. April–May.

GENERAL DISTRIBUTION. N India, Nepal, Myanmar, China (Hainan) and Indo-China.
ETYMOLOGY. From the Latin *obtusus* (obtuse) referring to the lateral lobes of the lip.
NOTE. This is the only subspecies of *C. bicolor* to occur in NE India (Du Puy & Cribb, 1988).

Section **Himantophyllum** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 103 (1924).

3. **C. dayanum** Rchb. f. in Gard. Chron. 1869: 710 (1869). Type: India, Assam, cult. Day s.n. (holo. W! Herb. no. 45964, iso. K!).

C. simonsianum King & Pantling in J. Asiat. Soc. Bengal 64(3): 338 (1896). Type: India, Sikkim, *Pantling* 51 (holo. K!, iso. BM!).

Plant epiphytic, 18–30cm tall. *Pseudobulbs* small, fusiform, covered by scarious remains of leaf bases and bladeless sheaths; sheaths becoming scarious-fibrous with age, c.18cm long. *Leaves* 5–8, distichous, linear-elliptic, acute to acuminate, erect to arching, dark green, coriaceous, 30–95 × 0.7–1.6cm; leaf base 3–8cm long. *Inflorescence* 5-to 15-flowered; peduncle short, suberect to horizontal, covered with sheaths; sheaths pink-veined, c.8cm long, cylindric at base, inflated above; rachis 5–7.5cm long; floral bracts triangular, acute, 0.2–1cm long. *Flowers* unscented, 4–5cm across; sepals and petals white to cream, central stripe maroon, lip white, strongly marked with maroon and yellow, callus white to cream, column maroon; pedicel and ovary 2–3cm long. *Sepals* subsimilar, narrowly elliptic to oblong-lanceolate, acute to shortly acuminate, erect, 2.5–3.4 × 0.6–0.8cm. *Petals* narrowly oblong to elliptic, obtuse to acute, porrect, covering the column, 1.8–2.8 × 0.5–0.75cm. *Lip* 3-lobed, 1.5–2.2 × 1–1.5cm (when spread); lateral lobes erect, clasping the column, tips triangular, porrect; mid-lobe ovate, entire, recurved, apex subacute, mucronate, minutely papillose; callus 2-ridged, glandular pubescent, c.0.2mm long. *Column* curved, 1.1–1.4cm long. *Fruit* ellipsoid, 4–6 × 1.5–2cm. **Plate 9.**

Bhutan: C – Tongsa (Tingtinbi (field record)) and Mongar (10km from Yongka La) districts; **Sikkim** (unlocalised *Pantling* specimen). In tropical valleys, in evergreen forest, in tree hollows, on fallen, rotting logs; 700–2230m. Fl. August–November.

GENERAL DISTRIBUTION. N India, Thailand, China, Cambodia, Taiwan, the Ryukyu Islands, Japan, the Philippines, W Malaysia, Sumatra and Sabah.

ETYMOLOGY. Named after John Day (1824–1888), an English amateur orchid grower and correspondent of Reichenbach, who was the first person to flower this species in cultivation.

Section **Bigibbarium** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 105 (1924).

4. **C. devonianum** Lindl. ex Paxton in Paxton's Mag. Bot. 10: 97 + fig. (1843). Type: India, Khasia Hills, Gibson, cult. Chatsworth (holo. [icon. in] Paxton's Mag. Bot. 10: 97 + fig. (1843)!)

Cymbidium sikkimense Hook. f., Fl. Brit. India 6(1): 9 (1890). Type: India, Sikkim, Lachen Valley, *Hooker* s.n. (holo. K!).

Plant epiphytic or lithophytic, 24–44cm tall. *Pseudobulbs* small, ovoid, covered by persistent leaf bases and bladeless sheaths, 2–3 × 1.5–2cm; sheaths 5 or 6, scarious, purple, c.10cm long. *Leaves* 2–4, suberect, elliptic, obtuse to subacute, oblique, mucronate, midrib prominent, 17–30 × 3.5–6.2cm; leaf base petiolate, channelled, c.15cm long. *Inflorescence* pendent, subsecund, densely 15- to 35-flowered; peduncle sheathed, 7–12cm long; sheaths 6 or 7, boat-shaped, acute, purple, c.6cm long; rachis 13–30cm long; floral bracts triangular, acute, 2–5mm long. *Flowers* 2.5–3.5cm across; sepals and petals pale yellow to dull olive-green, mottled with purple-brown, lip purple with dark maroon blotch on lateral lobes, disc cream, column greenish; pedicel and ovary 1.2–2.4cm long. *Sepals* subsimilar, elliptic, obtuse, erect to spreading, 2–2.9 × 0.7–1cm. *Petals* subquadrate, subacute to acute, 1.6–2.2 × 0.6–1cm. *Lip* broad, rhombic, minutely papillose, weakly 3-lobed, attached to short column foot, 1.4–1.6 × 1–1.5cm; lateral lobes obscure; mid-lobe triangular-ovate, c.8 × 8mm; callus reduced to 2 small swellings at base. Column clavate, winged at apex, 1.1–1.4cm; foot short. Fruit cylindric-ellipsoid, c.3.5 × 2cm.

Bhutan: C – Punakha district (Rimchu to Khosa, Tashitang (field record)); **Darjeeling** (Takdah); **Sikkim** (Chunthang, Lachen). On mossy rocks and moss-covered trees, in broken shade; 1300–2330m. Fl. April–June.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, S China (Yunnan) and N Thailand.
ETYMOLOGY. Named after William, 6th Duke of Devonshire (1780–1858), a great orchid collector and patron of horticulture, whose gardener Joseph Paxton first flowered this species at Chatsworth in 1843.

Section **Iridorchis** (Bl.) P.F. Hunt in Kew Bull. 24: 94 (1970).

5. C. **erythraeum** Lindl. in J. Proc. Linn. Soc., Bot. 3: 30 (1859). Type: India, Sikkim, Hooker 229 (holo. K-LINDL!).
Cymbidium longifolium sensu Lindl., Gen. Sp. Orchid. Pl.: 163 (1833), non D. Don.

Plant epiphytic or lithophytic, 25–75cm tall. *Pseudobulbs* ovoid, 2.5–5 × 1.5–5cm. *Leaves* 5–9, distichous, linear-oblong, tapering to fine point, 35–90 × 0.8–1.6cm; leaf base sheathing, 3–6cm long. *Inflorescence* erect to horizontal, arching, 5- to 14-flowered; peduncle sheathed, 9.5–20cm long; sheaths scarious, lanceolate, acute, 4–6cm long; rachis slender, 13–25cm long; floral bracts triangular, c.4 × 1.5mm (at base). *Flowers* fragrant, c.4 × 5cm (across); sepals and petals greenish, spotted and striped red-brown, lip yellowish to white, spotted red-brown, callus cream-white, column yellow, lateral lobes red-veined; pedicel and ovary 1.1–1.7cm long. *Sepals* similar, narrowly obovate, acute, 1.1–3.7 × 0.75–1.1cm. *Petals* narrow, oblong, acute, falcate, spreading, 3.6–4.4 × 0.5–0.8cm. *Lip* 3-lobed, adnate to base of the column for 2–4mm, c.2 × 1.6cm; lateral lobes erect, acute, pubescent-papillose, 0.7–1.2cm broad; mid-lobe cordate-reniform, acute, papillose, 0.9–1.1 × 1–1.4cm; callus 2-ridged, tapering to lip base, densely pubescent, indumendum not extending into mid-lobe. *Column* winged, sparsely pubescent, 2.3–2.9cm long. *Fruit* fusiform-ellipsoid, 5.5–6.5 × 2.5–3cm. **Plate 9.**

Bhutan: C – Punakha (Khelekha, between Ritang and Samtengang (F.E.H.2), around Tinglegang (F.E.H.2)) and Tongsa (Shemgang, near Tashiling (F.E.H.2)) districts; **Darjeeling** (Dumsong); **Sikkim** (between Chiya Bhanjang and Dentam). In hot valleys, on trees, rocks, roadsides and steep banks in open mossy evergreen oak forest; 1660–2330m. Fl. August–November; Fr. May.

GENERAL DISTRIBUTION. Nepal, N India, Myanmar and S China.
ETYMOLOGY. From the Greek *erythros* (red) in reference to the red-spotted lip.
NOTES. Lindley misapplied the name C. *longifolium* in 1833 and the names have been incorrectly used since; this nomenclatural confusion has been discussed by Hara (1985) and Du Puy & Cribb (1988a).

C. *erythraeum* resembles C. *iridioides* but differs in having smaller pseudobulbs, narrower leaves and smaller flowers; the lip is much smaller, and its margins are not strongly undulate.

6. C. **hookerianum** Rchb. f. in Gard. Chron. 1866: 7 (1866). Type: India, Khasia, cult. Veitch s.n. (holo. W! Herb. no. 44940).
Cymbidium grandiflorum Griff., Itin. Pl. Khasyah Mts.: 145, no.698 (1848); Not. Pl. Asiat. 3: 342 (1851); Ic. Pl. Asiat. 3: t.321 (1851). Type: Bhutan, Pimi, Griffith 5270 (holo. K!).
C. *giganteum* var. *hookerianum* (Rchb. f.) Bois ex Cogniaux in Lindenia 9: 13 (1893).
Cyperorchis grandiflora (Griff.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 107 (1924).

Plant epiphytic or lithophytic, 45–70cm tall. *Pseudobulbs* narrowly ovoid, 3–6 × 1.5–3.5cm. *Leaves* 4–8, linear-elliptic, acute, jointed, 40–80 × 1.4–2.1cm; leaf base sheathing, 4–10cm long. *Inflorescence* arching to pendent, 6- to 15-flowered; peduncle suberect, loosely sheathed, c.12cm long; sheaths scarious, lanceolate-ovate, acute, 8–10cm long; rachis zigzag, slender, 20–30cm long; floral bracts triangular, 4–6 × 2–3mm. *Flowers* strongly fragrant, 5–7cm across; sepals and petals apple-green, red-spotted at base, lip cream to yellow with green margins, maroon-spotted or blotched, callus cream with red spots; pedicel and ovary 3.5–6cm long. *Sepals* subsimilar, narrowly obovate, acute, 5.6–6 × 1.7–1.9cm; dorsal sepal porrect; lateral sepals spreading. *Petals* oblong to narrowly obovate, curved, spreading, 5.3–5.6 × 1.2–1.4cm. *Lip* 3-lobed, adnate to the column base for 4.5–5mm; lateral lobes triangular, acute to porrect, margins ciliate, papillose, 1.1–1.6cm broad; mid-lobe broadly ovate-cordate, mucronate, recurved, margin erose-undulate, 1.7–2 × 2.7–2.9cm; callus 2-ridged, pubescent. *Column* winged, pubescent-papillose ventrally, 3.3–4cm long. *Fruit* fusiform-ellipsoid, stalked, beaked, c.13 × 4cm. **Plate 9.**

Bhutan: S – Chukka (unlocalised *Ludlow, Sherriff & Hicks* specimen) and Deothang (Narfong (M.F.B.)) districts; C – Punakha (Nahi (field record), Nobding (field record), Tinlegang), Punakha/Tongsa (between Ritang and Rukubji), Tongsa (Jirgang Chu, near Tashiling, near Tongsa), Bumthang (near Yuto La (F.E.H.2)) and Mongar (Pimi, W side of Donga La) districts; **Darjeeling** (Kalimpong, between Ramman and Kali Khola, Sonada); **Sikkim** (Rimbi Chhu). On trees or steep banks in dense, damp forest, evergreen oak forest; 1660–2330m. Fl. February–May.

GENERAL DISTRIBUTION. E Nepal, NE India and SW China.

ETYMOLOGY. Named after Sir Joseph Hooker (1817–1911) who explored and collected extensively in the Sikkim Himalaya.

NOTE. Collections of this species from the Himalayas have commonly been reported under the name *C. grandiflorum* Griff.

7. **C. iridioides** D. Don, Prodr. Fl. Nepal.: 36 (1825). Type: Nepal, *Wallich* s.n. (holo. BM!).

Cymbidium giganteum sensu Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 163 (1833), *non* Sw. (1799). Type: Nepal, Sheopore, coll. *Wallich* Wall. Cat. 7355 (lecto. K-LINDL! K-W! designated by Du Puy & Cribb, The Genus Cymbidium: 115 (1988)).

Iridorchis gigantea (Wall. ex Lindl.) Bl., Coll. Orchid.: 91, t.26 (1858).

Cyperorchis gigantea (Wall. ex Lindl.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 107 (1924).

Plant epiphytic or lithophytic, 45–85cm tall. *Pseudobulbs* narrowly ovoid, 5–17 × 2–6cm. *Leaves* c.10, linear-elliptic, acute, mid-green, 35–90 × 1.5–4.2cm; leaf base sheathing, yellow-green, 6–15cm long. *Inflorescence* 7- to 20-flowered; peduncle sheathed, c.11cm long; rachis robust, tapering, 25–50 × 0.3–0.9cm (at base); floral bracts triangular, 2.5–5 × 2–3mm (at base). *Flowers* 4–8cm across, fragrant; sepals and petals yellowish-green, veined red to ginger-brown, lip yellowish, red-spotted, lateral lobes red-veined, callus yellowish spotted with maroon; pedicel and ovary 2.2–4.2cm long. *Sepals* subsimilar, narrowly obovate, acute, concave, porrect, 4.5–4.7 × 1.2–1.8cm. *Petals* oblong, curved, spreading, 4.4–4.8 × 0.7–1cm. *Lip* 3-lobed, adnate to the column base for 4–5mm, 1.5–2 × 1.4–1.8cm; lateral lobes triangular, porrect, margins fringed with short hairs, 1–1.2cm broad; mid-lobe ovate, mucronate, recurved, sparsely hairy, margins erose, pubescent, 1.2–1.6 × 1.4–1.8cm; callus 2-ridged, pubescent-ciliate. *Column* clavate, winged, 2.5–2.9cm long. *Fruit* fusiform-ellipsiod, 6–8 × 3–4cm.

Bhutan: S – Samchi (Dorkha forest (M.F.B.)) and Chukka (Marichong) districts; C – Mongar (between Mongar and Pakchang (M.F.B.)) and Tashigang (Jiri Chu) districts; **Darjeeling** (Dumsong, Kalimpong, Sureil); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). On trees, in dense forest; 1160–2330m. Fl. October–November.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and SW China.

ETYMOLOGY. From the genus *Iris* (Iridaceae) in reference to the leaf shape.

Section **Eburnea** Seth & P.J. Cribb in Arditti (ed.), Orchid Biol., Rev. Persp. 3: 304 (1984).

8. **C. eburneum** Lindl. in Bot. Reg. 33: t.67 (1847). Type: India, Meghalaya, Khasia Hills, cult. Loddiges (holo. K-LINDL!).

Cymbidium syringodorum Griff., Not. Pl. Asiat. 3: 338 (1851). Type: India, Khasia, *Griffith* 228 (holo. K-LINDL!).

Cyperorchis eburnea (Lindl.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 107 (1924).

Plant epiphytic, 25–50cm tall. *Pseudobulbs* ovoid to fusiform, covered with persistent leaf sheaths, 4–10 × 1–3cm. *Leaves* 15–17, distichous, narrowly oblong, apex unequally 2-lobed, minutely mucronate, 30–60 × 1–2cm; leaf base broad, sheathing, 5–10cm long. *Inflorescence* erect to suberect, 1- to 3-flowered; peduncle erect to suberect, sheathed, c.15cm long; sheaths 8–12, boat-shaped to cylindric, inflated, 9–15cm long; rachis short, 5–7cm long; floral bracts triangular, acute, 0.4–2cm long. *Flowers* showy, fragrant, 8–12cm across, white or pale pink, lip with a bright yellow central patch on mid-lobe and yellow callus, column flushed pale pink; pedicel and ovary 3.2–4.1cm long. *Sepals* similar, narrowly oblong-elliptic, acute, concave, 5.6–7.6 × 1.8–2.9cm; dorsal sepal porrect; *lateral sepals* not fully spreading. *Petals* narrowly spathulate, weakly falcate, acute, tips recurved, 5–7.3 × 1.5–2.2cm. *Lip* 3-lobed, elongate, adnate to base of the column for 4–6mm; lateral lobes clasping the column, papillose, apex rounded, 1.2–1.8cm broad; mid-lobe small, ovate-triangular, rounded to mucronate, porrect, puberulent, margins undulate, 1.6–2 × 1.4–1.7cm; callus long, 3-ridged, papillose, convergent and wedge-shaped at apex. *Column* clavate, narrowly winged, 4.1–4.6cm long. *Fruit* ellipsoid, shortly beaked, 7–10cm long.

Darjeeling (Rishap); **Sikkim** (unlocalised *Pantling* specimen). On trees in warm, damp forest; 300–1700m. Fl. March–May.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and S China.

ETYMOLOGY. From the Latin *eburneus* (ivory-white) in reference to the flower colour.

NOTE. This species with a usually single, large white flower is among the most beautiful of the genus and has been used extensively in hybridisation.

9. **C. mastersii** Griff. ex Lindl. in Bot. Reg. 31: t.50 (1845). Type: E Indies, cult. Loddiges (holo. K-LINDL!).

Cymbidium affine Griff., Not. Pl. Asiat. 3: 336 (1851); Icon. Pl. Asiat. 3: t.291 (1851). Type: India, Khasia, *Griffith* s.n. (holo.K-LINDL!).

C. micromeson Lindl. in J. Proc. Linn. Soc., Bot. 3: 29 (1859). Type: India, Khasia, *Griffith* s.n. (holo. K-LINDL!).

Cyperorchis mastersii (Griff. ex Lindl.) Bentham in J. Linn. Soc., Bot. 18: 318 (1881).

Cymbidium maguanense F.Y. Liu in Acta Bot. Yunnan 18(4): 412, f.2 (1996). Type: China, Yunnan, *F.Y. Liu* 88004 (holo. KUN!).

Plant epiphytic or lithophytic, 25–40cm tall; roots cauline. *Pseudobulbs* stem-like, surrounded by numerous, persistent leaf sheaths. *Leaves* 6–17, apical from pseudobulb, distichous, narrowly oblong, tapering, apex acute, unequally 2-lobed, mucronate, 16–50 × 0.8–1.8cm; leaf bases sheathing, persistent, 6–10cm long, margins membranous. *Inflorescence* curved to pendent, densely 5- to 10-flowered; peduncle suberect, sheathed, c.16cm long; sheaths 6–8, boat-shaped to cylindric, expanded, 10–14cm long; rachis 5–10cm long; floral bracts triangular, acute, 2–7mm long. *Flowers* fragrant, not opening fully, c.6cm across, white or pale pink, lip with a yellow patch at base, callus bright yellow, column white to pale green; pedicel and ovary 1.6–2.5cm long. *Sepals* similar, narrowly obovate, acute, concave, porrect, 4.3–5.2 × 0.8–1.1cm; *lateral sepals* weakly falcate. *Petals* narrowly oblong to obovate, weakly falcate, porrect, 3.9–4.9 × 0.5–0.7cm. *Lip* 3-lobed, elongate, adnate to the column base for 3–5mm; lateral lobes broad, clasping the column, puberulent, broadly rounded to subacute, margins fringed, 1–1.2cm; mid-lobe small, ovate, rounded or mucronate, porrect, puberulent, margins undulate, 1–1.3 × 1–1.3cm; callus long, 2-ridged. *Column* slender, narrowly winged, 3.3–3.6cm long. *Fruit* broadly ellipsoid, c.3 × 2.5cm.

Bhutan: S – Gaylegphug district (Rani Camp (M.F.B.)); **Darjeeling** (Pankhashari). On rocks or trees in evergreen forest, often in shade, on humus, moss or rotting wood, in *Quercus griffithii* and rhododendron forest; 900–2200m. Fl. October–December.

GENERAL DISTRIBUTION. NE India, Myanmar, China and Thailand.
ETYMOLOGY. Named after John White Masters (c.1792–1873), head gardener of the Calcutta Botanic Garden between 1836 and 1838.

Section **Cyperorchis** (Bl.) P.F. Hunt in Kew Bull. 24: 94 (1970); Seth & Cribb in Arditti (ed.), Orchid Biol., Rev. Persp. 3: 303 (1984).

10. C. **cochleare** Lindl. in J. Proc. Linn. Soc., Bot. 3: 28 (1859). Type: India, Sikkim, *Hooker* 235 (holo. K-LINDL!, iso. K!).
Cyperorchis cochlearis (Lindl.) Bentham in J. Linn. Soc., Bot. 18: 318 (1881).

Plant epiphytic, occasionally terrestrial, 30–65cm tall. *Pseudobulbs* small, narrowly ovoid, c.6 × 2.5cm. *Leaves* 9–14, distichous, linear, tapering to an acute apex, jointed, 50–90 × 0.6–1cm; leaf base broad, sheathing, 2.5–8cm long; bladeless sheaths c.5, scarious, sheathing. *Inflorescence* 7- to 20-flowered; peduncle suberect to horizontal or arching, sheathed; sheaths boat-shaped, inflated, c.6cm long; rachis slender, pendent; floral bracts triangular, scarious, c.5mm long. *Flowers* campanulate, waxy, pendent, c.2.5cm (in diameter); sepals and petals greenish-brown, margins pale, lip yellow or orange-yellow, red-brown spotted, column white-green; pedicel and ovary 0.8–3.2cm long. *Sepals* similar, narrowly obovate, acute, 3.9–4.5 × 0.6–0.9cm; *dorsal sepal* porrect; *lateral sepals* mucronate, not spreading. *Petals* narrowly oblong-obovate, subacute, weakly falcate, porrect, 3.8–4.4 × 0.4–0.6cm. *Lip* slender, elongate, deltoid, 3-lobed, adnate to column base for c.2mm, 4–4.5cm long; lateral lobes triangular, subacute, erect, glabrous, 1–1.2cm broad; mid-lobe small, cordate-elliptic, mucronate, porrect, margin minutely undulate, 0.8–1 × 0.8–1cm; callus 2-ridged, puberulent, the sides united, shell-shaped towards apex. *Column* slender, deflexed at apex, puberulent, 3.2–3.6cm long. *Fruit* broadly ellipsoid, beaked, c.2.5 × 1.5cm. **Plate 8.**

Darjeeling (Pankhashari); **Sikkim** (unlocalised *Hooker* specimen). In hot tropical valleys, in shade; 1660m. Fl. November–January.

GENERAL DISTRIBUTION. N India, China and Taiwan.
ETYMOLOGY. From the Latin *cochlearis* (spoon-like, concave) in reference to the spoon-like process formed by the union of the two lamellae on the lip.

11. C. **longifolium** D. Don, Prodr. Fl. Nepal.: 36 (1825). Lectotype: Nepal, Gossainkunde ('Gosaingsthan'), *Wallich* s.n. (BM!), designated by Hara in Taxon 34(4): 691 (1985).
Cymbidium elegans Lindl., Gen. Sp. Orchid. Pl.: 161 (1833). Type: Nepal, Gossaingsthan, *Wallich's collectors* Wall. Cat. 7354 (holo. K-LINDL!, iso. K-W!).
Cyperorchis elegans (Lindl.) Bl., Rumphia 4: 47 (1849).
Cymbidium densiflorum Griff., Not. Pl. Asiat. 3: 337 (1851). Type: India, Khasia, *Griffith* 229 (holo. K-LINDL!).
Grammatophyllum elegans (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 3: 548 (1853).
Cymbidium elegans var. *lutescens* Hook. f., Fl. Brit. India 6(1): 15 (1890). Type without provenance.
Cyperorchis longifolia (D. Don) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 108 (1924).

Plant epiphytic or lithophytic, 30–60cm tall. *Pseudobulbs* ovoid, 6–7 × 3–4cm. *Leaves* 7–13, distichous, linear-elliptic, acute, minutely 2-lobed at apex, jointed, 35–65 × 1.4–1.9cm; leaf base sheathing, 4–12cm long. *Inflorescence* slender, densely 20- to 35-flowered; peduncle suberect to horizontal, sheathed, 10–15cm long; rachis slender, pendent, 18–24cm long; floral bracts triangular, 1–6mm long. *Flowers* pendent, campanulate, not spreading, c.3cm across, cream to straw-yellow, tinged pink, lip cream to pale green, sparsely red-spotted, callus orange-yellow; pedicel and ovary short, 0.8–2cm long. *Sepals* similar, narrowly obovate, acute, concave, 3.2–4.3 × 0.7–1.1cm; *dorsal sepal* porrect, covering column; *lateral sepals* not spreading, mucronate. *Petals* narrowly oblong-obovate, obtuse, weakly falcate, porrect, 3.1–4.2 × 0.4–0.8cm. *Lip* 3-lobed, deltoid, elongate, adnate to base of column for 2–3mm; lateral lobes triangular, erect or clasping the column, apex acute to subacute, entire, 0.6–0.8cm broad; mid-lobe small, base oblong, apex 2-lobed, emarginate, centrally pubescent, margins undulate, 0.6–1 × 0.4–0.8cm; callus 2-ridged. *Column* slender, puberulent, narrowly winged, 2.8–3.4cm long. *Fruit* broadly ellipsoid, 2–2.7 × 1.3–2cm.

Bhutan: S – Chukka (Tala) and Deothang (Satsalor) districts; C – Punakha (Lamperi, Rimchu), Tongsa (Tingtinbi (field record)), Mongar (Khinay Lhakang, near Lhuntse (M.F.B.), Unjar Chu) and Tashigang (Shali) districts; **N** – Upper Kulong Chu (near Tobrang (M.F.B.)); **Darjeeling** (Dumsong, Kalimpong, Mongpu, Takdah); **Sikkim** (Chakung, Lusing, Rathang Chhu, Rimbi Chhu, Thinglen, between Yoksam and Bakhim). On trees in damp shady forest, overhanging streams, with *Eurya*, *Rhododendron* and *Daphniphyllum* sp.; 1000–2500m. Fl. October–December(–February); Fr. May.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and SW China.

ETYMOLOGY. From the Latin *longi-* (long) and *-folius* (leaved).

NOTES. This species is better known under the name of C. *elegans* published by Lindley in 1833 and based on a Wallich collection from Nepal in the Wallich Herbarium. Hara (1985) showed that Don based his earlier name of C. *longifolium* on specimens collected by Wallich in the Lambert Herbarium and proposed the restoration of the earlier name for this species. Du Puy & Cribb (1988a, b) argued that restoring this name would lead to confusion and applied for the earlier name to be rejected, but their proposal was rejected (Taxon 39(2): 296, proposal 913, 1990).

12. C. whiteae King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 193, t.258 (1898). Type: India, Sikkim, Gangtok, *Pantling* 425 (holo. K!).

Cyperorchis whiteae (King & Pantling) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 107 (1924).

Plant epiphytic, 20–30cm tall. *Pseudobulbs* narrowly ovoid, c.10 × 2.5cm. *Leaves* 12–14, distichous, narrowly oblong, arching, acute, jointed, c.90 × 1.3cm; leaf base sheathing, margins scarious, c.3mm wide. *Inflorescence* arching, pendent, 10- to 12-flowered; peduncle suberect, arching, sheathed; sheaths boat-shaped, inflated, c.14cm long; floral bracts triangular, 2–8mm long. *Flowers* campanulate, suberect to pendent, c.3.5cm in diameter, sepals and petals greenish, flushed and spotted with red-brown, lip white with pale yellow mid-lobe, maroon-spotted, callus white; pedicel and ovary 1.5–2cm long. *Sepals* similar, narrowly oblong-elliptic, acute, concave, porrect, 4.3–4.8 × 1.1–1.2cm; *lateral sepals* somewhat spreading. *Petals* oblong-obovate, acute, weakly falcate, porrect, 4.1–4.5 × 0.7–0.9cm. *Lip* 3-lobed, elongate, adnate to base of column for c.5mm; lateral lobes triangular, erect, puberulent, porrect, acute, 1.1cm broad; mid-lobe cordate, acute, mucronate, deflexed at apex, puberulent, 1.2–1.3 × c.1.2cm; callus 2-ridged, long, broad, raised, glabrous, confluent at apex. *Column* broad, narrowly winged, puberulent, c.3.5cm long. *Fruit* cylindric, beaked, c.3.5 × 1.5cm.

Sikkim (Gangtok). On *Schima wallichii* and *Castanopsis* sp. in evergreen forest; 1500–2000m. Fl. October–November.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. Named after Mrs Claude White, wife of the Political Agent for Sikkim, who collected the type specimen.

Section Jensoa (Rafinesque) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 102 (1942).

13. C. **munronianum** King & Pantling in J. Asiat. Soc. Bengal 64(3): 338 (1896). Type: India, Sikkim, Teesta (Tista) Valley, *Pantling* 256A (holo. AMES!).

Cymbidium ensifolium var. *munronianum* (King & Pantling) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 91 (1951).

Plant terrestrial, c.60cm tall. *Pseudobulbs* small, ovoid, prominent, covered in scarious bladeless sheaths and leaf bases, c.3 × 2cm. *Leaves* 3 or 4, broadly linear-elliptic, erect, jointed, 60–80 × 1.8–2.7cm; leaf bases 3–5cm long; bladeless sheaths scarious, becoming fibrous with age, c.11cm long. *Inflorescence* 8- to 13-flowered; peduncle sheathed; sheaths 5, short, clasping, appressed, distant, c.5cm long; floral bracts small, triangular, 2–8mm long. *Flowers* fragrant, 2.5–3.5cm across; sepals and petals pale green or yellow-cream, lined with purple-brown, lip pale yellow with pink lateral lobes, margins red and mid-lobe blotched in red; pedicel and ovary 1.2–2.5cm long. *Sepals* subsimilar, oblong-elliptic, obtuse, erect, 1.6–2.6 × 0.5–0.65cm; *lateral sepals* spreading. *Petals* ovate, subacute, ± porrect, 1.6–2.2 × 0.6–0.9cm. Lip 1.2–2cm long (when spread); lateral lobes erect, prominent, minutely pubescent; mid-lobe small, narrowly oblong, minutely papillose, entire, weakly undulate, 7–8 × 4–7mm; callus 2-ridged, converging to a small tube at base of mid-lobe. *Column* 0.7–1.1cm long, curved, narrowly winged. *Fruit* fusiform, c.5cm long.

Bhutan: C – Punakha district (Nahi); **Duars** (Jaldacca River); **Darjeeling** (unlocalised *Cowan* specimen); **Sikkim** (Tista River Valley). 500–1700m. Fl. December–May.

GENERAL DISTRIBUTION. E Himalaya.

ETYMOLOGY. Named after James Munro, a friend of Pantling, a plant lover and a Sikkim resident.

NOTES. *C. munronianum* is related to *C. ensifolium* subsp. *haematodes* and *C. sinense*. Du Puy & Cribb (1988) included a table comparing the three species and stated that *C. munronianum* replaced *C. ensifolium* in N India and that *C. sinense* had not been recorded from the Himalayas.

Bose & Bhattacharjee (1980) reported *C. ensifolium* as occurring in the Sikkim Terai. There is a short description, but no illustration, and we suspect that this report is based upon a misidentification. Chowdhery (1998) reported *C. ensifolium* from Kameng in Arunachal Pradesh but we suspect that this might also represent a misidentification of *C. munronianum*.

C. kanran Makino is also closely related to *C. munronianum* from which it differs in having dark green leaves that are glossy above, larger flowers, a dorsal sepal longer than 30mm, porrect sepals that cover the column and a larger mid-lobe longer than 12mm. It has been suggested (D.B. Gurung, pers. comm.) that the Bhutan material might belong to this species but further field work is required before this can be confirmed.

Section **Maxillarianthe** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 101 (1924).

14. C. **cyperifolium** Lindl., Gen. Sp. Orchid. Pl.:163 (1833). Type: Bangladesh, Sylhet, coll. *F. De Silva* & *H. Bruce* Wall. Cat. 7353 (holo. K-LINDL!, iso.K-W! K!).

Cymbidium viridiflorum Griff., Itin. Pl. Khasyah Mts.: 53 (1848). Type: Bhutan, *Griffith* s.n. (holo. K-LINDL!).

C. carnosum Griff., Not. Pl. Asiat. 3: 339 (1851). Type: India, Khasia, *Griffith* 185 (holo. CAL).

Cyperorchis wallichii Bl., Coll. Orchid.: 92 (1858), nom. alt.

subsp. **cyperifolium**

Plant terrestrial, 23–43cm tall. *Pseudobulbs* small, inconspicuous. *Leaves* 7–10, distichous, forming a weak fan, narrowly elliptic, acute, erect, entire, obscurely jointed, 50–90 × 0.9–1.5cm; leaf base 4–6cm; bladeless sheaths leaf-like, margins membranous, becoming scarious-fibrous. *Inflorescence* 4- to

7-flowered; peduncle sheathed; sheaths slender, distant, c.8cm long; floral bracts linear to narrowly ovate, 1.5–4cm long. *Flowers* fragrant, 4–5cm across; sepals and petals apple-green to yellow-green, lined in red-brown, lip pale green-white, streaked or spotted purple, column green to yellow; pedicel and ovary 1.3–3.5cm long. *Sepals* subsimilar, narrowly oblong-elliptic, acute, erect, 2.5–3.5 × 0.5–0.8cm; *lateral sepals* spreading. *Petals* ovate-elliptic, acute, porrect, 1.9–2.9 × 6–9cm. *Lip* 1.7–2.2cm long (when spread); lateral lobes rounded, minutely pubescent-papillose; mid-lobe oblong-ovate, obtuse to subacute, recurved, entire, papillose, 0.9–1.3 × 0.8–1.1cm; callus 2-ridged, converging at base of mid-lobe, forming a tube. *Column* curved, narrowly winged, 1–1.5cm long. *Fruit* fusiform, 5–7cm long.

Bhutan: S – Deothang district (near Satsalor); C – Punakha (Tinlegang) and Tongsa (Shemgang (M.F.B.)) districts; (unlocalised *Griffith* specimen); **Sikkim** (Bakhim, Chunthang). In temperate rainforest, on steep banks, in shade, beside moss-covered rocks; 1500–2750(–3330)m. Fl. (October–)November–January.

GENERAL DISTRIBUTION. Nepal, NE India, China, Myanmar, Thailand, Cambodia and the Philippines.

ETYMOLOGY. From the Greek *cyperos* (a sedge-like marsh plant) and the Latin *-folius* (leaved).

15. C. **faberi** Rolfe in Bull. Misc. Inform. Kew 1896: 198 (1896). Lectotype: China, Chekiang (Zhejiang), Mt Tientai, *Faber* p.p. (K!), designated by Du Puy & Cribb (1988).

var. **szechuanicum** (Y.S. Wu & S.C. Chen) Y.S. Wu & S.C. Chen in Acta Phytotax. Sin. 18: 299 (1980). Types: China, Szechuan (Sichuan), Chion-lai-shan, Y.S. *Wu* 2040 (holo. PE).

Cymbidium cyperifolium sensu Duthie in Ann. Roy. Bot. Gard. (Calcutta) 9: 135 (1906), non Lindl.

C. *szechuanicum* Y.S. Wu & S.C. Chen in Acta Phytotax. Sin. 11: 33 (1966).

Plant terrestrial, 26–62cm tall. *Pseudobulbs* small, covered by bladeless sheaths, sheaths becoming fibrous with age. *Leaves* 5–9(–13), distichous, narrowly elliptic, acute, arching, margins entire to serrulate, petiolate, jointed, 30–65 × 0.4–1.1cm. *Inflorescence* basal, erect, 4- to 15-flowered; peduncle covered with sheathing bracts; peduncle bracts c.6.5cm long; floral bracts narrowly triangular, 0.8–4cm long. *Flowers* pendent, not opening fully, fragrant, c.6cm across; sepals and petals green to yellowish, lip yellowish-green, edged with white and spotted with red, lateral lobes lined and edged with red; pedicel and ovary 1.4–3.2cm long. *Dorsal sepal* narrowly elliptic to oblong-elliptic, acuminate, suberect, 2.6–3.6 × 0.58–1.04cm; *lateral sepals* similar, spreading. *Petals* ovate-elliptic, acute to acuminate, porrect, 2–3.3 × 0.6–1.1cm. *Lip* 3-lobed, 1.9–3.3cm long (when flattened); lateral lobes erect, rounded, minutely papillose; mid-lobe long, narrowly oblong, apex broad, mucronate, recurved, surface papillose, margins minutely fimbriate-erose, undulate and crisped; callus 2-keeled. *Column* curved, narrowly winged, 1.2–1.9cm long. *Fruit* fusiform to cylindric-fusiform, shortly beaked, erect, c.5cm long.

Bhutan: C – Punakha district (Nahi). 1000–2900m. Fl. March–June.

GENERAL DISTRIBUTION. NW India, Nepal and China.

ETYMOLOGY. From the province of Szechuan (now spelled Sichuan) in China, where the type specimen was collected.

NOTES. This plant has been reported from Nepal and is very closely related to, and often confused with, C. *cyperifolium* subsp. *cyperifolium*. This is the first record of the species from Bhutan.

16. C. **goeringii** (Rchb. f.) Rchb. f. in Walpers, Ann. Bot. Syst. 3: 547 (1852). Type: Japan, *Göring* s.n. (holo. W! Herb. no. 45003).

Maxillaria goeringii Rchb. f. in Bot. Zeitung (Berlin) 3: 334 (1845).

C. *mackinnonii* Duthie in J. Asiat. Soc. Bengal 71(2): 41 (1902). Type: India, Mussoorie, *Mackinnon* 22709 (holo. K!).

C. forrestii Rolfe in Notes Roy. Bot. Gard. Edinburgh 8: 23, t.11 (1913). Type: China, Yunnan, *Forrest* 415 (holo. E).

C. yunnanense Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 74 (1919). Type: China, Yunnan, *Henry* 11792 (holo. B).

var. **goeringii**

Plant terrestrial; roots thick, fleshy. *Pseudobulbs* small, ovoid, enclosed in bladeless sheaths. *Leaves* 5–7, narrowly elliptic, acute, arching, margins serrate, 40–80 × 0.2–1cm. *Inflorescence* erect, 1-flowered; peduncle slender, sheathed, c.15cm long; sheaths cylindric at base, boat-shaped above, apex acute, 5.5–7cm long; floral bracts scarious, boat-shaped, acute, 2.5–6cm long. *Flower* 4–5cm across; sepals and petals apple-green to red-brown, stained red towards base, lip cream with crimson spots, callus cream to pale yellow, column pale green; pedicel and ovary 2.5–6cm long. *Sepals* subsimilar, obovate to elliptic, obtuse to apiculate, margins incurved, 2.5–3.9 × 0.85–1.25cm; *dorsal sepal* porrect; *lateral sepals* spreading. *Petals* oblong-ovate to oblong-elliptic, obtuse, usually covering the column, 1.85–3 × 0.85–1.1cm. *Lip* subentire to 3-lobed, 1.7–2.6 × 1–1.6cm (when spread); lateral lobes reduced, erect, rounded, papillose; mid-lobe broadly ovate to oblong, obtuse to rounded, recurved, papillose, 0.7–1 × 0.75–1.1cm; disc with 2-ridged callus. *Column* 2-winged at apex, 1.3–1.9cm long. *Fruit* fusiform, erect, c.8cm long.

Bhutan: C – Punakha district (Lobesa, Nahi). In open *Pinus roxburghii* and *P. bhutanica* forest, on lightly shaded cliffs or slopes; 500–3000m. Fl. January–March.

GENERAL DISTRIBUTION. NW India, China, Korea, Japan, Taiwan and the Ryukyu Islands.
ETYMOLOGY. Named after Philip Friedrich Wilhelm Göring (1809–1876) who collected the type in Japan.
NOTES. This is the first record of the species from our area. It is closely related to *C. cyperifolium* subsp. *cyperifolium* and differs in having narrower leaves (less than 0.9cm broad) and sepals and petals usually cream with pale greenish veins (rather than green or yellowish with red-brown on the veins). This species has previously been reported from the NW Himalaya (as *C. mackinnonii* Duthie).

Section **Geocymbidium** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 101 (1924).

17. **C. lancifolium** Hook., Exot. Fl.: t.51 (1823). Type: Nepal, *Wallich* s.n., cult. Shepherd (holo. K!).
C. javanicum Bl., op. cit. 380 (1825). Type from Java.
C. gibsonii Lindl. & Paxton in Paxton's Fl. Gard. 3: 144 (1852–3). Type: India, Khasia, cult. Chatsworth (holo. K-LINDL!).
C. javanicum var. *pantlingii* F. Maekawa, loc. cit. (1958). Type: India, Sikkim, *Pantling* 75 (holo. CAL, iso. BM! K!).

Plant terrestrial, 7–35cm tall; roots thick, fleshy, stilt-like. *Pseudobulbs* narrowly fusiform, fleshy, 5–15 × c.1.2cm. *Leaves* 2–5, narrowly obovate-elliptic, plicate, petiolate, acute, 9–50 × 1.9–5.5cm; leaf base sheath-like, 0.5–8cm long; bladeless sheaths green at first, later scarious and fibrous. *Inflorescence* erect, lateral from pseudobulb, 4- to 8-flowered; peduncle sheathed; sheaths overlapping, boat-shaped, acute, 1.2–3.4cm long; floral bracts lanceolate, boat-shaped, acute, 0.4–1.6cm long. *Flowers* 3.7–5cm across; sepals and petals white to apple-green, centrally striped with maroon, lip white, pale green or yellow, red-spotted, callus white; pedicel and ovary 1.9–4cm long. *Sepals* similar, narrowly oblong to obovate, acute to apiculate, erect, 1.7–3 × 0.3–0.8cm. *Petals* oblong to narrowly elliptic, acute to apiculate, 1.5–2.3 × 0.4–0.8cm. *Lip* 3-lobed, minutely papillose, 1.4–2 × 0.8–1.5cm; lateral lobes narrow, rounded; mid-lobe ovate, obtuse, recurved at apex, 0.6–1.2 × 0.6–1.4cm; callus 2-ridged, convergent towards apex, tubular towards base of the mid-lobe. *Column* slender, curved, winged, 1–1.5cm long. *Fruit* fusiform to clavate, 4.5–5 × 1–1.4cm.

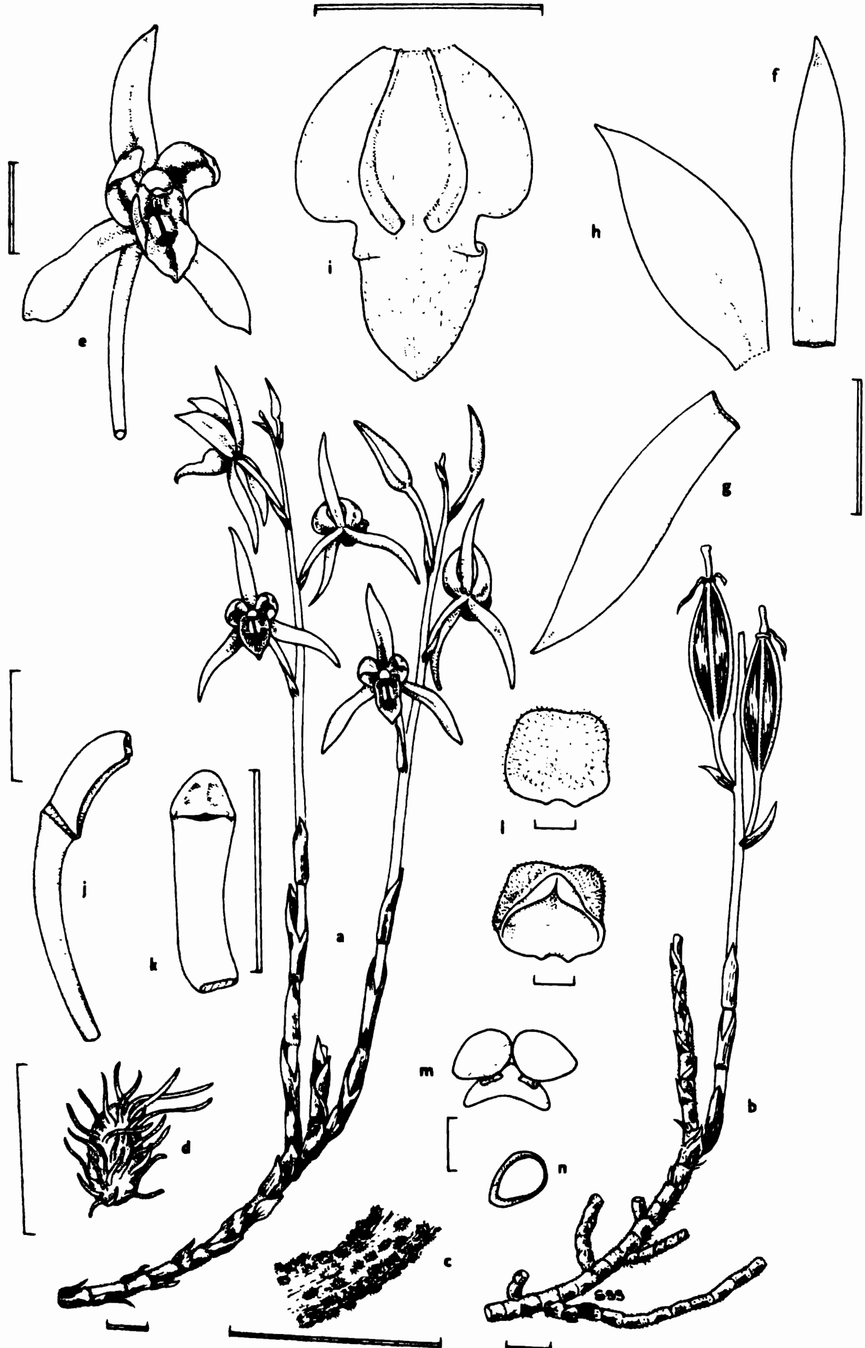


Fig. 60. ***Cymbidium macrorhizon***: a, habit (flowering); b, habit (fruiting); c, rhizome (detail); d, rhizome tubercle (detail); e, flower; f, dorsal sepal; g, lateral sepal; h, petal; i, lip; j, column and ovary; k, column (front view); l, anther cap (two views); m, pollinarium; n, pollinium (detail). Drawn by Susanna Stuart-Smith, a, c–j from *Pradhan* 22 (K); b from *Sander* s.n. (K); k–n based on f.30 in Du Puy & Cribb (1988).

Bhutan: C – Punakha (Rimchi, Tinlegang) and Tashigang (near Gamdrithang (M.F.B.)) districts; **Sikkim** (Nanga). In deep shade, in broad leaved forest; 300–2300m. Fl. April–October; Fr. August.

GENERAL DISTRIBUTION. Nepal, N India, China, Taiwan, Japan, Myanmar, Indo-China to Malaysia, Java, Sumatra and Borneo.
ETYMOLOGY. From the Latin *lancifolius* (with lanceolate leaves).

Section **Pachyrhizanthe** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 73 (1919).

18. **C. macrorhizon** Lindl., Gen. Sp. Orchid. Pl.: 162 (1833). Type: Kashmir, icon. Royle (holo. K-LINDL!).

Plant mycotrophic, terrestrial, leafless, 7–32cm tall; *roots* short, arising towards apex of rhizome; *rhizome* subterranean, branching, soft, fleshy, tuberculate, 3–8mm in diameter; nodes 0.2–1.5cm apart. *Inflorescence* erect, terminal from rhizome, 3- to 6-flowered; peduncle sheathed; sheaths 4–8, overlapping, ovate, boat-shaped, 1.3–2.7cm long; floral bracts oblong-lanceolate, acute, 0.2–1.7cm long. *Flowers* 3–4cm across; sepals and petals cream to pale yellow or brownish-pink, purple-red striped, lip white, red-spotted, callus white; pedicel and ovary 1–3.7cm long. *Sepals* subsimilar, narrowly obovate-oblong, acute, erect, 1.9–2.6 × 0.4–0.6cm; *lateral sepals* spreading. *Petals* narrowly elliptic, oblique, acute, porrect, 1.4–2 × 0.5–0.7cm. *Lip* rhombic, subentire to 3-lobed, minutely papillose, 1.2–1.7 × 0.9–1.1cm (when spread); lateral lobes erect, obtuse; mid-lobe triangular-oblong, acute to obtuse, recurved, margins undulate, 5–7 × 4–6mm; callus 2-ridged, convergent towards base of the mid-lobe, forming a tube. *Column* slender, curved, narrowly winged, 0.9–1.3cm long. *Fruit* fusiform-ellipsoid, 3–5 × 0.9–1.2cm. **Fig. 60; Plate 9.**

Darjeeling (Kalimpong, Relli Chhu Valley). In broad-leaved monsoon and pine forest, in damp humus, in shade; 800–2500m. Fl. May–August.

GENERAL DISTRIBUTION. Pakistan, N India, Nepal, Myanmar, Thailand, China, Laos, Japan and the Ryukyu Islands.
ETYMOLOGY. From the Greek *makro-* (large) and *rhizon* (roots), a reference to the rhizome.

Hybrids, doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

C. × gammieanum King & Pantling in J. Asiat. Soc. Bengal 64(3): 339 (1896). Type: India, Sikkim, *Pantling* 299 (holo. CAL!, iso. W!).

NOTES. Vij & Shekhar (1987) identified this as a natural hybrid between *C. elegans* and *C. iridioides* based on cytological investigations. Du Puy & Cribb (1988a) identified it as a natural hybrid between *C. elegans* and *C. erythraeum* and noted that, in Sikkim, natural hybrid swarms displayed all stages of intermediacy between the parents.

C. lowianum (Rchb. f.) Rchb. f. in Gard. Chron. n.s., 11: 332, 404, t.56 (1879). Type: Myanmar (Burma), *Boxall*, cult. Low (holo. W! Herb. no. 44988, 44989).
Cymbidium giganteum var. *lowianum* Rchb. f. in Gard. Chron. n.s., 7: 685 (1877).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh, but we have seen no material from our area.

C. sinense (Jackson ex Andrews) Willdenow, Sp. Pl. ed.4(1): 111 (1805). Type: [icon. in] Bot. Repos. 3: t.216 (1802)!
Epidendrum sinense Jackson in Bot. Repos. 3: t.216 (1802).

NOTE. Reported by Rao (1997) from Tipi in the W Kameng district of Arunachal Pradesh, but we have seen no material from our area.

Subtribe **Acriopsidinae** Dressler

60. **Acriopsis** Reinwardt ex Bl.

Plants epiphytic; *rhizome* creeping, branched; *roots* slender, branched, fleshy, bearing ascending catch-roots. *Pseudobulbs* crowded, ovoid, covered at base by slender, silvery sheaths. *Leaves* apical, midrib sunken above, prominently raised beneath, petiolate. *Inflorescence* racemose or paniculate, many-flowered, arising from base of pseudoulb; peduncle long, terete; floral bracts persistent. *Flowers* small, twisted, non-resupinate, widely open. *Sepals* lanceolate, concave at apex; lateral sepals fused to form a synsepalum. *Petals* spreading, oblong to obovate. *Lip* 3-lobed, pandurate to entire; disc 2-keeled. *Column* straight to S-shaped; stelidia 2, long, parallel, porrect or decurved; rostellum beak-like, bifurcate; pollinia 4, connate in 2 pairs.

The genus *Acriopsis* was proposed in 1823 by Carl Blume in his *Catalogus* based on a name suggested by Caspar Reinwardt (1773–1854). The name was however, a nomen nudum and was not validated until 1825 by Blume in his *Bijdragen tot de Flora van Nederlandsch Indië*. The genus comprises six species distributed in N India, through SE Asia, the Malay Peninsula, Indonesia and the Philippines to Australia.

Dressler (1981) placed *Acriopsis* in its own subtribe and the genus has been monographed by Minderhoud & de Vogel (1986).

TYPE. *Acriopsis javanica* Reinwardt ex Bl. (= A. *liliifolia* (König) Ormerod).
ETYMOLOGY. From the Greek *acris* (locust) and *opsis* (appearance), from the supposed resemblance of the column to a locust.

272 1. **A. liliifolia** (König) Ormerod in Opera Bot. 124: 58 (1995). Type: Thailand, Phuket Island, *König* (holo. lost, copy of original mss. [with icon.] LINN).
Epidendrum liliifolium König in Retzius, Observ. Bot. 6: 61 (1791).
Acriopsis javanica Reinwardt ex Bl., Bijdr.: 377 (1825). Type: Java, Mt Salak, *Blume* s.n. (lecto. L! Herb. no. 90232256, selected by Minderhoud & de Vogel in Orchid Monographs 1: 11 (1986)).
A. harae Tuyama in J. Jap. Bot. 39(5): 129, f.1, t.3 (1964). Type: India, Sikkim, Gangtok, *M. Togashi* s.n. (holo. TI).

Plant glabrous, 16–115cm tall; *rhizome* 2–6mm. *Pseudobulbs* with 5–7 internodes, 1.3–6 × 1–3cm. *Leaves* 3 or 4, linear, acute to obtuse, 5–28 × 0.3–2cm; petiole 1.5–2.5cm long. *Inflorescence* paniculate, 12- to c.200-flowered; peduncle 8.5–55cm long; peduncle scales appressed, 0.4–1.6cm long; rachis 8–38cm long; floral bracts broadly lanceolate, acute, 1.5–3 × 0.5–1.5mm. *Flowers* 0.8–1 4cm across; sepals and petals greenish white to cream, blotched or striped purple, lip cream, purple stained; pedicel and ovary 3–6.4 × c.0.4mm. *Dorsal sepal* 3-veined, acute, 4.7–7.2 × 1–2.8mm; *synsepalum* 4- to 6-veined, obtuse, 4.5–6.2 × 1.4–3.2mm. *Petals* oblong to obovate, obtuse, 3- to 5-veined, 4.3–6.8 × 1.5–3mm. *Lip* variable, 3-lobed; hypochile partially adnate to column, constricted in middle; epichile glabrous, with triangular-rectangular lateral lobes, obovate, apex rounded to emarginate, 3.8–5 × 2.5–5mm; disc with keels 0.6–1.3 × 0.4–0.6mm. *Column* straight, 3.8–6mm long; stelidia with swollen tips, decurved, 0.9–1.5mm long; rostellum beak-like, 0.9–1.3mm long. *Fruit* globose to ellipsoid, 0.9–2.4 × 0.8–1cm. **Fig. 61.**

Sikkim (Gangtok (Tuyama, 1964)).

GENERAL DISTRIBUTION. NE India, Thailand, Indo-China, Malaysia, Indonesia, the Philippines, NE Australia and the Solomon Islands.

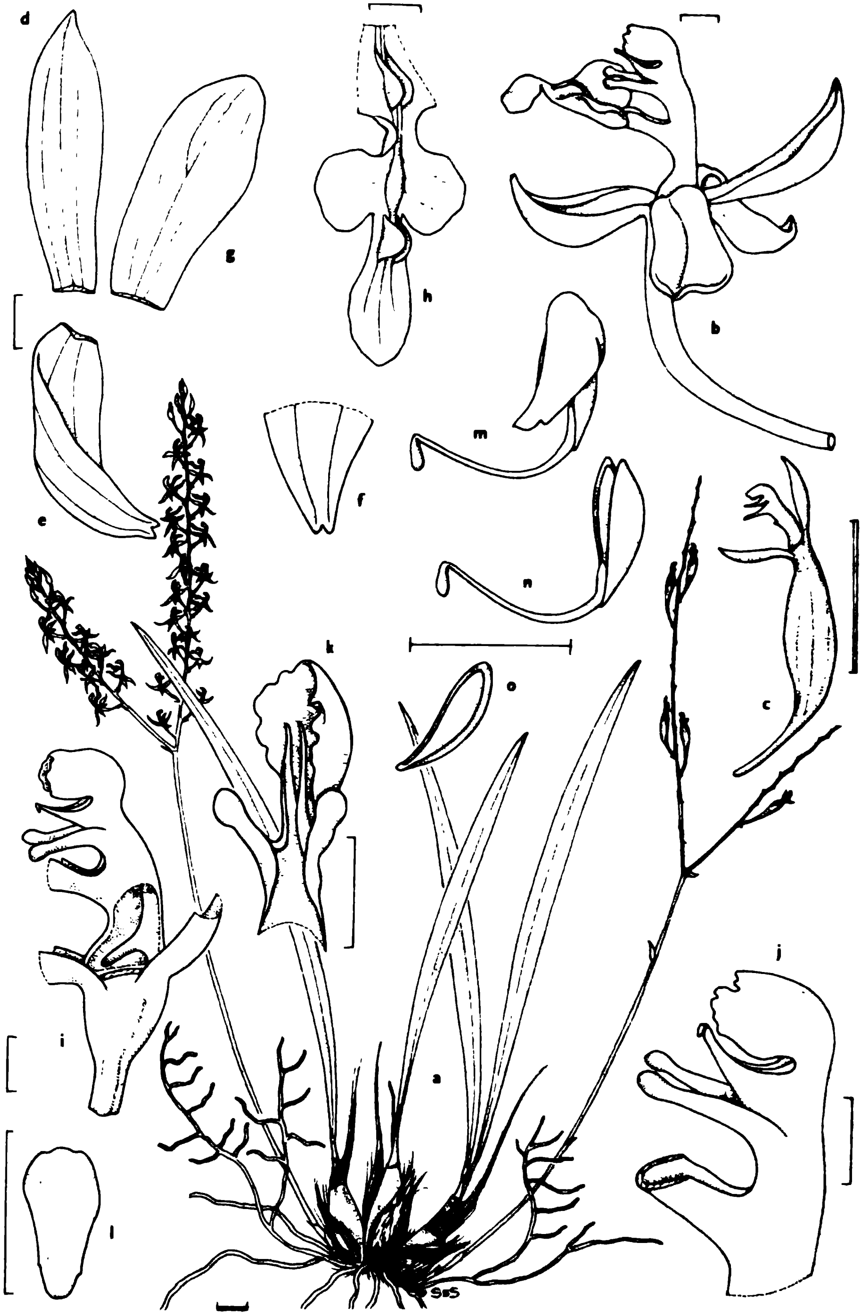


Fig. 61. **Acriopsis liliifolia**: a, habit; b, flower; c, sepals, ovary and column; d, dorsal sepal; e, lateral sepal; f, lateral sepal (detail); g, petal; h, lip; i–j, column (side view); k, column apex (front view); l, anther cap (top view); m, pollinarium; n, pollinarium (with anther cap removed); o, pollinium. Drawn by Susanna Stuart-Smith from *Put* 2764 (K).

ETYMOLOGY. From the Latin *lili-* (lily-like) and *-folia* (leaved).
NOTES. Tuyama (1964) described *A. harae* from Sikkim. It was collected by Togashi from the Gangtok region and flowered in cultivation in the Shinjuku Gyoen National Garden. It was considered to be distinct in having a 3-lobed lip and the callus with a single lamella that had no trace of apical bilobation. Tuyama pointed out that the *A. javanica* group was variable across its wide distribution and needed to be reinvestigated. A full synonymy can be found in Minderhoud & de Vogel (1986) under *A. javanica* var. *javanica* (under which they include *A. harae*). Seidenfaden (1995a) considered that *A. javanica* was conspecific with the earlier *Epidendrum liliifolium* König and reduced *A. javanica* to synonymy. We follow this treatment pending a decision on the possible conservation of *A. javanica*.

Tribe **Arethuseae** Lindl.

Subtribe **Bletiinae** Bentham

We follow Senghas (1984) in our treatment of this subtribe.

61. Acanthephippium Bl.

Plants terrestrial; *roots* few, short, unbranched. *Pseudobulbs* conical to cylindric, covered by persistent sheath fibres and leaf sheaths. *Leaf* jointed, plicate; petioles sheathing. *Inflorescence* lateral, arising from node on new shoot or pseudobulb, erect, short, few-flowered; peduncle hidden by sheaths; floral bracts leafy, boat-shaped. *Flower* large, showy, resupinate, fleshy, urceolate to campanulate; ovary grooved, finely pubescent. *Sepals* fleshy, connate at base, forming a large, swollen tube enclosing the petals and lip. *Petals* elliptic to spathulate, free, appressed to the sepaline tube. Lip 3-lobed, jointed at apex of column foot: lateral lobes hatchet-shaped, erect; mid-lobe triangular to oblong, reflexed from the middle; disc variably keeled. Column straight, broad, winged; column foot long, adnate to the lateral sepals forming a mentum; stigma broadly ovate to obovate; pollinia 8, in 2 groups of 4, ellipsoid. Fruit ellipsoid, ridged.

The genus *Acanthephippium* was described in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië* using the spelling *Acanthophippium*, this orthographic error was corrected by Blume in the preface to his *Florae Javae* (1828). Sprague (1928) accepted the error as unintentional and adopted the alteration. The genus comprises 11 species distributed in SE Asia, Japan, the Malay Archipelago and the Pacific islands.

Acanthephippium is easily distinguished from all other genera by its very characteristic jug-shaped flowers hence the common name of 'jug orchid'. The genus has recently been revised by Thomas (1997) and a fuller synonymy can be found there.

TYPE. *Acanthophippium javanicum* Bl., orth. var.
ETYMOLOGY. From the Greek *acantha* (thorn) and *ephippion* (saddle), probably a reference to the shape of the lip, which, with its two parallel crests, resembles a saddle.

Key to species

1. Mentum spur-like; flowers cream or white with red stripes .... **1. A. striatum**
+ Mentum saccate, not spur-like; flowers yellow spotted with red .... **2. A. sylhetense**

1. **A. striatum** Lindl. in Bot. Reg. 24: 41, misc.68 (1838). Type: Nepal, via Bateman; cult. Kew (holo. K-LINDL).

Plant to 50cm tall; *roots* few, c.20 × 0.3cm. *Pseudobulbs* ovoid to cylindric, 3- to 5-noded, covered by persistent sheath fibres, c.15 × 2.5cm. *Leaves* 1 or 2, elliptic to obovate, acute, petiolate, prominently 3- to 5-veined below, 19–25 × 6–10cm; petiole sheathing, ribbed, 3–6cm long. *Inflorescence* 3- to 10-flowered; peduncle bracteate, 7–10cm long; peduncle bracts many, membranous, ovate, clustered

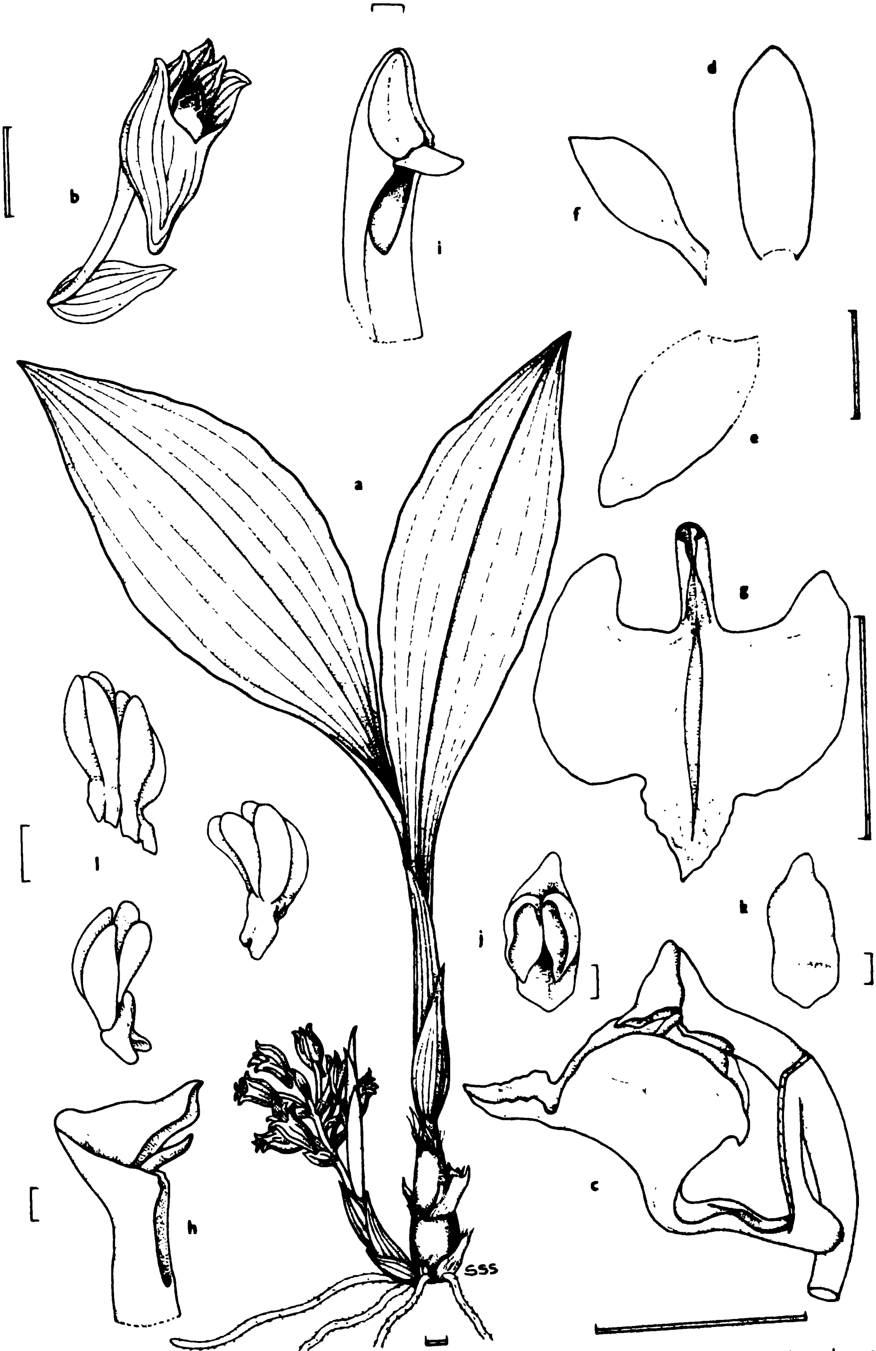


Fig. 62. **Acanthephippium striatum**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (side view); i, column; j, anther (front view); k, anther (back view); l, pollinarium (3 views). Drawn by Susanna Stuart-Smith, a from ***Pantling*** 269 (K); b–h, j–l from ***Fraser & Rolfe*** s.n. (K); i **based on** plate 65 in Thomas (1997).

towards apex, 2.5–5.1cm long; rachis c.5cm long; floral bracts leafy, ovate-lanceolate, acute, 1.5–2.6 × 2–2.6cm. *Flowers* thin-textured, cream or white, red-veined; pedicel and ovary grooved, finely pubescent. *Dorsal sepal* oblong, obtuse, adnate to the lateral sepals, 5-veined, 1.5–2.9 × 1–1.4cm; *lateral sepals* obliquely oblong, obtuse, recurved, 5- to 7-veined, 3–3.8 × 1.5–2cm. *Petals* obovate to oblong, fleshy, minutely pubescent at base, 7-veined, 2.3–2.9 × 0.8–1.1cm. *Lip* 3-lobed, membranous; lateral lobes erect, rounded, 0.8–0.9 × 1–1.1cm; mid-lobe small, triangular, c.0.6 × 0.4cm; callus on disc a single, low median keel; *mentum* narrowed towards apex, spur-like, 3–5mm long. *Column* straight, 1–1.4 × 0.4–0.5cm; foot forming a mentum with the lateral sepals, c.4cm long. **Fig. 62.**

Duars (Kumai, near the Jaldacca River); **Darjeeling** (unlocalised Griffith specimens); **Sikkim** (Gangtok Orchid Sanctuary). 660–1650m. Fl. April–July.

GENERAL DISTRIBUTION. India, China, Thailand, Vietnam, Taiwan, Malaysia and Java.
ETYMOLOGY. From the Latin *striatus* (striped) referring to the sepals.
NOTE. This is a very variable species, with a flower that is more membranous than any other member of the genus.

2. **A. sylhetense** Lindl., Gen. Sp. Orchid. Pl.: 177 (1833). Type: Bangladesh, Sylhet, *Hooker & Thomson* 198 (holo. K-LINDL!).
Acanthephippium ringiflorum Griff., Not. Pl. Asiat. 3: 347 (1851); Icon. Pl. Asiat. 3: 325 (1851). Type: India, Assam, *Griffith* s.n. (holo. CAL?).

Plant to 50cm tall; roots few, c.12cm long. *Pseudobulbs* ovoid-cylindric, basal half covered by presistent sheath fibres, apical half sheathed by petioles, c.17 × 1.5–3cm; internodes 6. *Leaves* 2 or 3, elliptic to oblong-elliptic, acute to acuminate, 5-veined beneath, 24–40 × 7–10cm; petioles sheathing, 5–17cm long. *Inflorescence* 3- to 6-flowered; peduncle hidden by leaf sheaths, 3–9cm long; rachis 1–3cm long; floral bracts boat-shaped, leafy, pale purple, ovate-lanceolate, acute, 9- to 11-veined, 2–2.9 × 1.7–2.2cm. *Flowers* fragrant, fleshy, yellow, sepals red-spotted at apex; pedicel and ovary grooved, puberulent, 3–4cm long. *Dorsal sepal* oblong, obtuse, adnate to lateral sepals, 5-veined, 2.5–3 × 1.3–1.5cm; *lateral sepals* obliquely oblong, obtuse, recurved, 5-veined, 3.8–4.5 × 1.8–2cm. *Petals* obovate, fleshy, 5-veined, 2.7–3.1 × 1.4–1.5cm. *Lip* 3-lobed; lateral lobes hatchet-shaped, erect, 0.7–0.8 × 0.5–0.6cm; mid-lobe linear, thick, oblong, dilated at apex, reflexed about the middle, laterally grooved at apex, 0.6–0.8 × 0.4–0.5cm; callus 3- to 5-keeled, dentate, c.6mm long; *mentum* obtuse at apex, 2.5–3cm long. *Column* straight, 1.3–1.4 × 0.5–0.7cm; foot inflexed, 4–4.5cm long. Fruit c.6cm long.

Sikkim (unlocalised *Pantling* specimen). In tropical valleys; 500–1300m. Fl. April–October.

GENERAL DISTRIBUTION. India, Bangladesh, Myanmar, Thailand, China, Taiwan and Japan.
ETYMOLOGY. From the town of Sylhet (now in Bangladesh) where the type specimen was collected.

62. Ania Lindl.

Plants terrestrial; *roots* arising from nodes of the shoots, not branched. *Pseudobulbs* with one to several internodes, conical. *Leaf* single, petiolate. *Inflorescence* lateral, from base of pseudobulb, erect, racemose; peduncle bracts tubular. *Flowers* resupinate. *Sepals* and *petals* elliptic to obovate, entire. Lip usually spurred, blade entire to 3-lobed; adaxially 3- to 7-keeled. *Column* semi-terete, winged; pollinia 8, in 4 pairs. *Fruit* ellipsoid.

The genus *Ania* was established in 1831 by John Lindley in his *Genera and Species of Orchidaceous Plants*. The genus comprises eight species distributed in India, Myanmar, China, Thailand, Vietnam, the Malay Peninsula, Sumatra, Java, Borneo, the Philippines, Ambon and New Guinea.

The genus has recently been reviewed by Turner (1992) and a fuller synonymy can be found there.

LECTOTYPE. *Ania angustifolia* Lindl.

ETYMOLOGY. From the Greek *ania* (trouble) perhaps an allusion to the uncertain taxonomic position of the genus at the time of its establishment.

Key to species

1. Lip with 3 keels .... **1. A. penangiana**
+ Lip with 5 to 7 keels .... **2. A. viridifusca**

1. A. penangiana (Hook. f.) Summerhayes in Bot. Mag. 161: t.9553 (1939). Type: Malaysia, Penang, *Maingay* 1642 (holo. K!, iso. L! Herb. no. 9023222237).
Tainia penangiana Hook. f., Fl. Brit. India 5(2): 820 (1890).
T. hookeriana King & Pantling in J. Asiat. Soc. Bengal 64(3): 336 (1896). Type: India, Sikkim, Teesta (Tista) valley, *Pantling* 204A/B (holo. BM!, iso. AMES! FI K! LE W).
Ascotainia hookeriana (King & Pantling) Ridley, Mat. Fl. Malay. Penins. 1: 116 (1907).
A. penangiana (Hook. f.) Ridley, *loc. cit.* (1907).
Ania hookeriana (King & Pantling) T. Tang & F.T. Wang ex Summerhayes in Bot. Mag. 161: t.9553 (1939).

Plant 40–55cm tall. *Pseudobulbs* erect, conical, internodes several, 3–5.2 × 0.5–2.9cm. *Leaf* elliptic, acute to acuminate, margins entire, 30–49 × 3.5–9.2cm; petiole 15–36cm long. *Inflorescence* laxly 5- to 15-flowered; peduncle glabrous, bracteate, 30–75cm long; peduncle bracts 4–6, acute, 2.2–4.1cm long; rachis 11–42cm long; floral bracts spreading, lanceolate, acute, 0.3–2.4cm long. *Flowers* opening simultaneously, c.2cm across; sepals and petals greenish-brown to yellow, lip white to cream, faintly purple spotted; pedicel and ovary 0.9–2.3cm long. *Dorsal sepal* elliptic, acute to acuminate, 1.6–3.4 × 0.2–0.7cm; *lateral sepals* elliptic, straight to falcate, acute to acuminate, 1.1–3.6 × 0.2–0.7cm. *Petals* obliquely elliptic, weakly falcate, acute to acuminate, 1.3–3.1 × 0.3–0.6cm. *Lip* spurred, 3-lobed, elliptic to obovate, 1.1–1.8 × 0.7–1.2cm; lateral lobes obliquely triangular, weakly falcate; mid-lobe rhombic to orbicular, apex acuminate, margins entire, weakly undulate, glabrous; disc 3-keeled, 0.55–1.3cm long; *spur* 2–4mm long. *Column* 0.7–1cm long. **Fig. 63.**

Duars (unlocalised *Haines* specimen); **Darjeeling** (Rishap). In tropical evergreen forest, on forested riverbanks; 600–830m. Fl. February–March.

GENERAL DISTRIBUTION. NE India, China (Hainan), Thailand, Vietnam and the Malay Peninsula.

ETYMOLOGY. From Penang (in W Malaysia) where the type specimen was collected.

NOTE. Turner (1992) reduced *A. hookeriana* (the name usually applied to the Himalayan plants) to the synonymy of *A. penangiana*.

2. A. viridifusca (Hook.) T. Tang & F.T. Wang ex Summerhayes in Bot. Mag. 161: t.9553 (1939). Type: India, Assam, *Simon* s.n. (holo. probably lost); Lectotype (selected here): [icon. in] Bot. Mag. 78: t.4669 (1852)!
Calanthe viridifusca Hook. in Bot. Mag. 78: t.4669 (1852).
Tainia viridifusca (Hook.) Bentham ex Hook. f., Fl. Brit. India 5(2): 820 (1890).
Ascotainia viridifusca (Hook.) Schltr., Orchideen: 317 (1914).

Plant 60–150cm tall. *Pseudobulbs* erect to prostrate, obliquely ovoid to ellipsoid, internodes several, 2.2–5 × 3.2–10cm. *Leaf* elliptic, acute to subacuminate, membranous, many-veined, 46–55 × 4.3–8.2cm; petiole c.39cm long. *Inflorescence* 20- to 30-flowered; peduncle 30–100cm long; peduncle scales 6 or 7, acute, 3–4.6cm long; rachis 23–55cm long; floral bracts spreading to reflexed, acute, 0.4–2.4cm long. *Flowers* opening together; sepals and petals drab purplish-brown to pale green with a red mid-vein, lip cream-yellow, spotted with lilac; pedicel and ovary 1.1–2.3cm long. *Dorsal sepal* elliptic to obovate, acute to acuminate, 2.1–3.2 × 0.4–0.5cm; *lateral sepals* elliptic-obovate, falcate, acuminate, 2–2.9 × 0.4–0.55cm. *Petals* obliquely elliptic to obovate, weakly falcate, acuminate, 1.8–2.7 ×

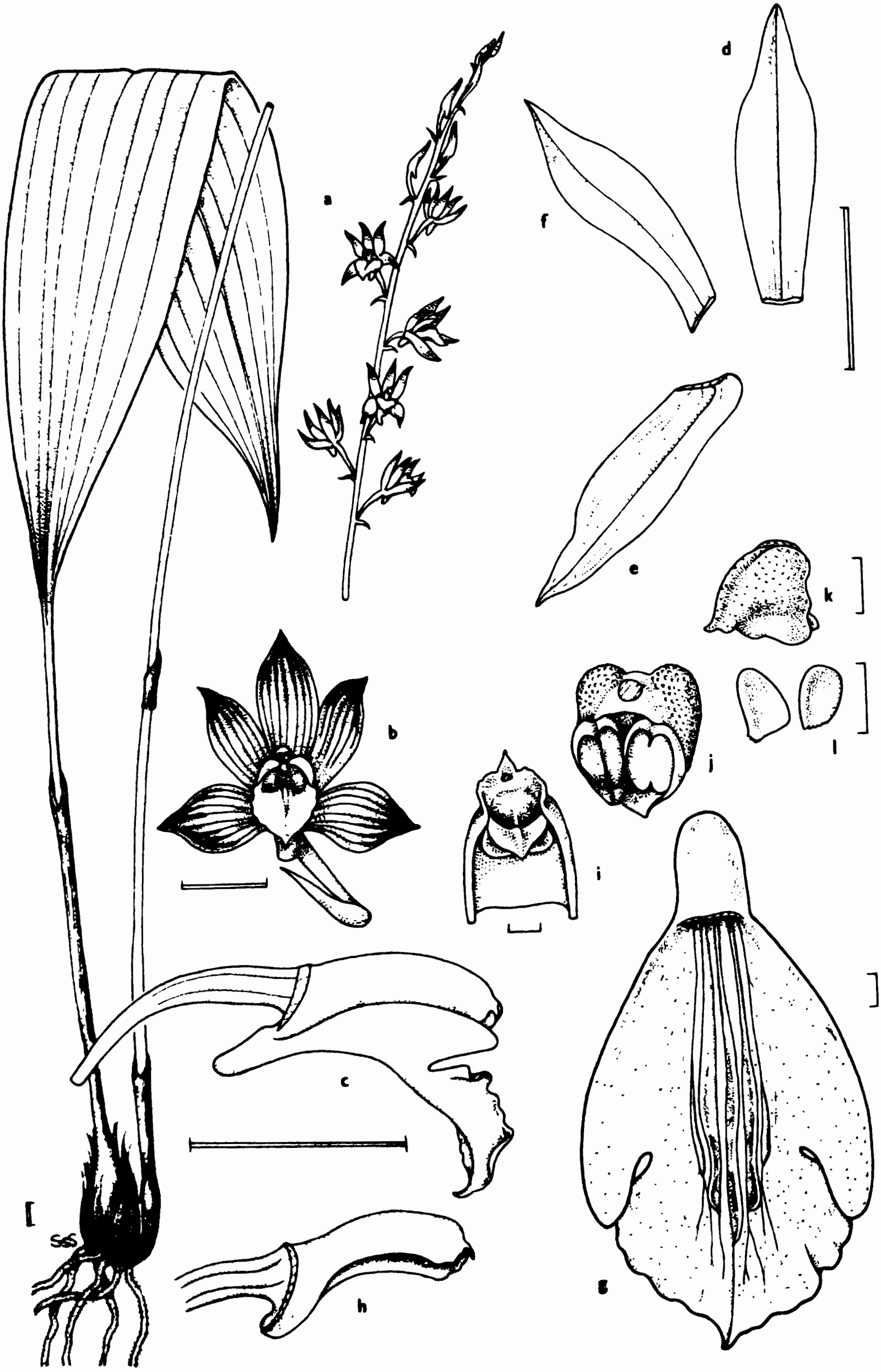


Fig. 63 ***Ania penangiana***: a, habit; b, flower; c, ovary, column and lip (side view); d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (side view); i, column apex; j, anther (front view); k, anther (side view); l, pollinia. Drawn by Susanna Stuart-Smith, a from *Pantling* 204 (K); b–l from cult. Kew 24806 (K).

0.4–0.5cm. Lip spurred, 3-lobed, elliptic-obovate, 1.1–1.4 × 0.8–0.9cm; lateral lobes obliquely triangular to elliptic, obtuse; mid-lobe elliptic, acuminate, margins entire, minutely papillose; disc 5- to 7-keeled from base to apex, undulate, glabrous; spur 1–3mm long. Column winged, 0.8–1cm long.

Sikkim (Bose & Bhattacharjee, 1980). In evergreen forest, on open banks; 1200–1500m. Fl. January–May.

GENERAL DISTRIBUTION. NE India, Myanmar, China (Yunnan), Thailand and Vietnam.
ETYMOLOGY. From the Latin *viridi-* (green) and *fuscus* (brownish), a reference to the flower colour.
NOTE. We have seen no material of this species from our area. Bose & Bhattacharjee (1980) reported it from Sikkim, mentioning that the disc was 5-keeled and we include it here on the basis of that description.

63. **Anthogonium** Wall. ex Lindl.

Plants terrestrial, slender. *Pseudobulb* small, ovoid, partly subterranean. *Stem* leafy, arising from pseudobulb apex. *Leaves* sessile, sheathing. *Inflorescence* lateral or basal from pseudobulb, racemose to sub-paniculate. *Flowers* resupinate, not opening widely, somewhat tubular, borne at an angle to the ovary. *Sepals* connate to form a sepaline tube, gibbous at base. *Petals* elongate-spathulate. *Lip* simple, adnate to the column base, subtriangular in outline, apex obscurely 3-lobed. *Column* long, slender, apex abruptly bent; pollinia 4.

The genus *Anthogonium* was established in 1840 by John Lindley in his *Genera and Species of Orchidaceous Plants*. The genus is monotypic and is distributed from the Himalayas, through Myanmar, China and SE Asia.

TYPE. *Anthogonium gracile* Lindl.
ETYMOLOGY. From the Greek *anthos* (flower) and *gonia* (angle) in reference to the angle at which the tubular flower is joined to the ovary.

1. **A. gracile** Lindl., Gen. Sp. Orchid. Pl.: 426 (1840). Type: Nepal, Sheopore, coll. *Wallich* Wall. Cat. 7398 (holo. K-LINDL!, iso. K-W!).
Anthogonium sp. Griffith, Not. Pl. Asiat. 3: 383 (1851); Icon. Pl. Asiat. 3: t.345 (1851).
A. griffithii Rchb. f. in Bonplandia 2: 90 (1851). Type: India, Khasia (Assam), Churra, *Griffith* s.n. (holo. K-LINDL!).
A. corydaloides Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 66, 230 (1919). Type: China, Yunnan, *E. Maire* (holo. B).

Plant 14–40cm tall. *Pseudobulbs* ovoid, 0.5–1.9 × 0.8–1.6cm. *Stem* sheathed at base, 2- to 5-leaved at apex, 3–6.5cm long; sheaths clasping, c.2.5cm long. *Leaves* oblong-lanceolate to narrowly elliptic, acuminate, many-veined, 7–30 × 0.4–3.2cm. *Inflorescence* laxly 5- to 10-flowered; peduncle slender, glabrous, intermittently sheathed, 10–35cm long; sheaths tubular, 0.5–2cm long; rachis glabrous, 1–9cm long; floral bracts lanceolate, long-acuminate, 0.5–0.7 × 0.1–0.15cm. *Flowers* 1–1.8cm long, dark pink to white, lip spotted dark purple, anther bright yellow; pedicel and ovary 1–1.8cm long. *Sepals* oblanceolate, weakly falcate, subacute, connate in lower half to form a narrow, cylindric sepaline tube (gibbous at base), upper half free, spreading, 1.1–1.9cm long. *Petals* elongate-spathulate, linear at base, 1–1.6cm long. *Lip* adnate to column base, simple, c.1 × 0.8–0.9cm (at apex); base narrow, expanding towards apex; apex obscurely 3-lobed, emarginate. *Column* slender, apex dilated, abruptly bent and narrowly 2-winged at apex, c.8mm long. *Fruit* narrowly ellipsoid, 1–2.4 × 0.3–0.5cm. **Fig. 64; Plate 10.**

Bhutan: S – Chukka (2km below Chima Kothi) and Deothang (near Wamrong) districts; **C** – Thimphu (Dotena), Punakha (1km S of Rimchu, Tang Chu, Tinlegang), Tongsa (Shemgang, Tongsa Guest House), Tongsa/Bumthang (Yuto La), Mongar (Kuru Chu N of Lhuntse) and Tashigang (near Tashi Yangtsi) districts; **N** – Upper Kuru Chu district (near Denchung); **Darjeeling** (Dumsong,

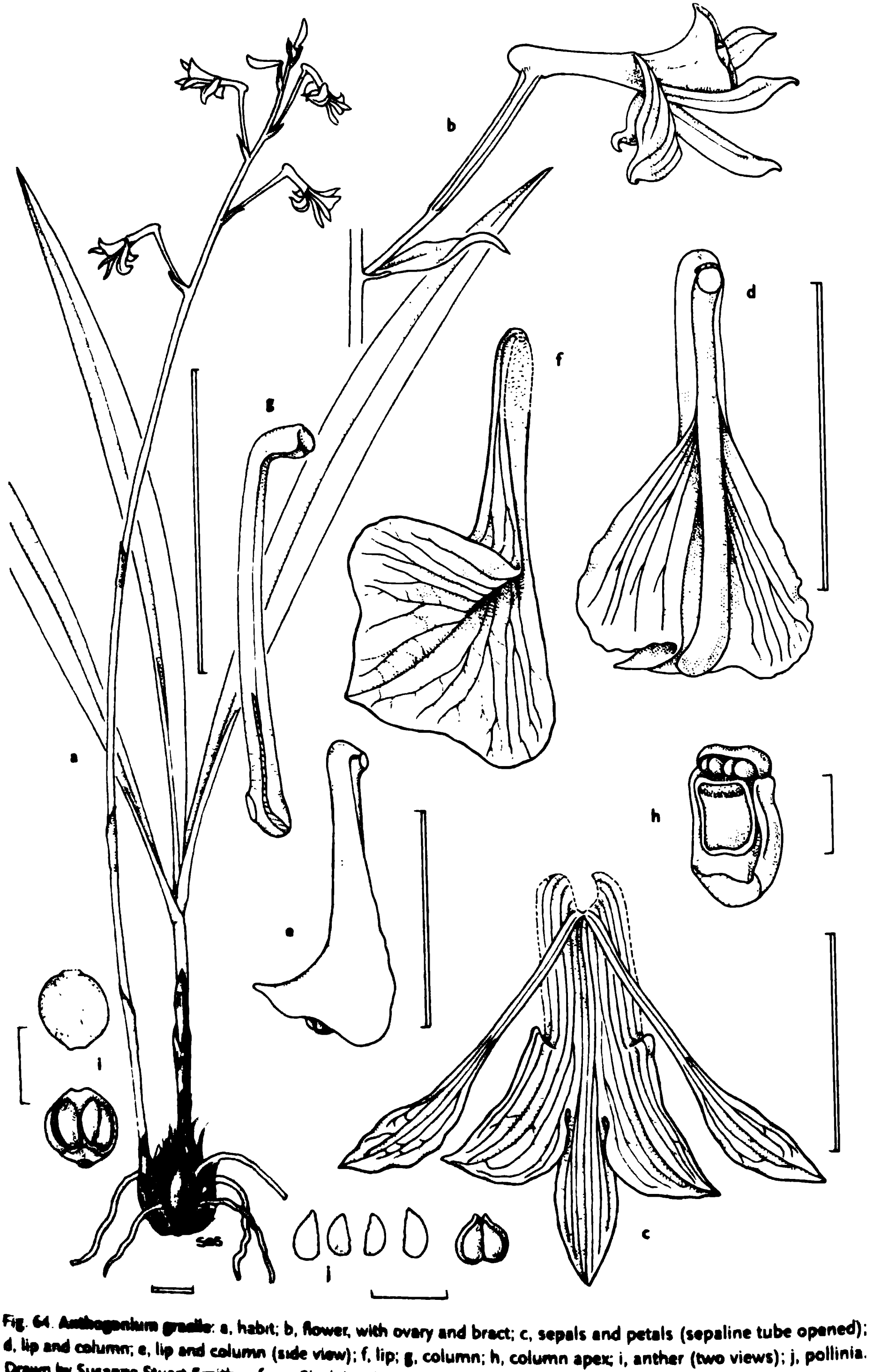


Fig. 64. ***Anthogonium gracile***: a, habit; b, flower, with ovary and bract; c, sepals and petals (sepaline tube opened); d, lip and column; e, lip and column (side view); f, lip; g, column; h, column apex; i, anther (two views); j, pollinia. Drawn by Susanna Stuart-Smith, a from *Sinclair & Long* 4950 (K); b–j from *Ludlow, Sherriff & Hicks* 17022 (K).

Kurseong, Rimbik, Tonglu); **Sikkim** (Gangchung, Rishi, Yoksam). Shady banks, in warm broad-leaved forest, on dry exposed hilltops, on rock ledges; 1300–3000m. Fl. June–October.

GENERAL DISTRIBUTION. N India, Nepal, Myanmar, China to Thailand, Laos, Cambodia and Vietnam.
ETYMOLOGY. From the Latin *gracilis* (thin, slender), probably referring to the peduncle.

64. Calanthe R. Br.

Plants terrestrial; *roots* thick, long, pubescent. *Stems* pseudobulbous, long or short; *pseudobulbs* small, ovoid, covered by leaves. *Leaves* 2 to several, often clustered, persistent, rarely deciduous, narrowly elliptic to linear-elliptic, plicate, petiolate to subsessile. *Inflorescence* axillary, terminal or arising from base of pseudobulb, erect, long or short, few- to many-flowered, racemose; floral bracts persistent or deciduous. *Flowers* resupinate, small to large and showy. *Sepals* and *petals* similar, free, spreading, rarely connivent. Lip entire, 3- or 4-lobed, adnate to column base, usually spurred; mid-lobe often deeply bifid; disc with basal warty calluses or lamellae. Column short (rarely long), fleshy, truncate; pollinia 8.

The genus *Calanthe* was described in 1821 by Robert Brown in the *Botanical Register*. The genus comprises about 100 species from tropical, subtropical and warm temperate regions from Africa to Asia and the Pacific Islands with a single species in the tropical Americas.

Schlechter (1912) revised the genus and proposed a sectional delimitation that was followed by Seidenfaden (1975a) and which we adopt here.

Dressler (1993) suggested that Lepidopteran pollination was to be expected in *Calanthe* which seems to be a floral analogue of the American *Epidendrum*.

TYPE. *Calanthe triplicata* (Willemet) Ames; basionym: *Orchis triplicata* Willemet.
ETYMOLOGY. From the Greek *kalos* (beautiful) and *anthos* (flower).

Key to species

1. Inflorescence distinct from leaf bearing stem and arising directly from rhizome; floral bracts caducous 2
+ Inflorescence and leaf bearing stem arising together from pseudobulb; floral bracts persistent .. 3

2. Inflorescence cylindric, subdensely many-flowered; rachis 10–14cm long; peduncle 21–26cm long; spur clavate .... **20. C. clavata**
+ Inflorescence globose-corymbose to subcylindric; densely many-flowered; rachis 1–3cm long; peduncle 9–18cm long; spur weakly clavate .... **21. C densiflora**

3. Flowers spurless 4
+ Flowers with a spur 5

4. Mid-lobe of lip lacking lamellae; sepals, petals and lip lilac .... **13. C. puberula**
+ Mid-lobe of lip with 3 to 5 raised, keeled lamellae; sepals and petals green; lip orange-red to brown, base yellow .... **15. C. tricarinata**

5. Lip simple 6
+ Lip 3-lobed 9

6. Margins of lip fimbriate .... **2. C. alpina**
+ Margins of lip not fimbriate 7

7. Lip base long-clawed, apex deeply 2-lobed; flowering September to December .... **3. C. biloba**
+ Lip base not long-clawed, apex not deeply 2-lobed; flowering May to June 8

8. Lip trowel-shaped, margins crenulate; sepals and petals chocolate-brown, lip white; lip base with 2 converging lamellae .... **17. C. trulliformis**
+ Lip elliptic-quadrate, shallowly 2-lobed at apex; sepals, petals and lip yellow to yellow-green; lip with 3 papillose ridges .... **18. C. whiteana**

9. Lip margins deeply fimbriate .... **9. C. keshabii**
+ Lip margins not deeply fimbriate 10

10. Spur less than 3mm long 11
+ Spur more than 4mm long 12

11. Flowers brick-red to purple, more than 3cm across, spreading; lip with 3 lamellae on mid-lobe only .... **4. C. brevicornu**
+ Flowers pale green to dull brown, less than 1cm across, pendent; lip with 3 lamellae from base to apex .... **10. C. mannii**

12. Spur 0.45–1.2cm long 13
+ Spur more than 1.5cm long 16

13. Mid-lobe of lip with a large raised keel 1–2mm tall .... **7. C. griffithii**
+ Mid-lobe of lip lacking a keel 14

14. Mid-lobe of lip with erose-undulate margins, broadly ovate, not deeply divided; sepals and petals yellow-green .... **5. C. chloroleuca**
+ Mid-lobe of lip with entire margins, not broadly ovate, deeply divided; sepals and petals white 15

15. Leaves broadly ovate-elliptic, more than 6cm broad; petiole more than 6cm; callus at base of lip 3- to 5-lobed .... **1. C. alismifolia**
+ Leaves not broadly ovate-elliptic, less than 6cm broad; petiole less than 6cm long; callus semi-circular, warty .... **11. C. odora**

16. Flowers yellow-green, brownish purple or white 17
+ Flowers crimson, purple or pale violet 19

17. Sepals and petals white .... **16. C. triplicata**
+ Sepals and petals green or brown 18

18. Sepals and petals less than 1.5cm long, green .... **8. C. herbacea**
+ Sepals and petals more than 1.8cm long, brownish-purple .... **19. C. yuksomnensis**

19. Lip lacking a callus; flowers crimson-maroon to deep purple .... **6. C. fulgens**
+ Lip with a callus; flowers purple to violet 20

20. Callus of lip 3-ridged, extending from base to apex; mid-lobe narrow, expanding to a spathulate to trowel-shaped apex; flowering February to April .... **12. C. plantaginea**
+ Callus of lip 3-lobed basal; mid-lobe broadly flabellate or wedge-shaped to reniform; flowering August to September .... **14. C. sylvatica**

Section **Calanthe**

1. **C. alisimifolia** Lindl., Fol. Orchid. Calanthe 6,7: 8, no.27 (1855). Types: India, Sikkim, *Hooker* 239A (syn. K-LINDL!); Khasia, *Hooker & Thomson* 239B (syn. K-LINDL!).

Calanthe japonica Bl. ex Miquel in Ann. Mus. Bot. Lugduno-Batavi. 2: 205 (1866). Type from Japan.
Alismorchis alismifolia (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).
A. japonica (Bl. ex Miquel) Kuntze, *loc. cit.* (1891).
Calanthe fauriei Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 66 (1919). Type from Japan.
C. nigropuncticulata Fukuyama in Bot. Mag. (Tokyo) 48: 437 (1934). Type from Taiwan.
C. austrokiusiuensis Ohwi in Acta Phytotax. Geobot. 5: 55 (1936). Type from Japan.
C. furcata var. *alismifolia* (Lindl.) Hiroe, Orchid Flowers 2: 88 (1971).

Plant 20–40cm tall; *rhizome* short, woody. *Pseudobulbs* slender, cylindric, tapering, 1–2 × 1–1.5cm. *Leaves* 2 or 3, elliptic to ovate-elliptic, acuminate, petiolate, 10–23 × 5–13cm; petiole narrow, strongly veined, 7–22cm long. *Inflorescence* erect, racemose to sub-corymbose, many-flowered; peduncle sheathed, pilose-pubescent, 6–30cm long; sheaths distant, lanceolate, acute, c.2 × 0.5cm; rachis pilose-pubescent, 4–10cm long; floral bracts spreading to reflexed, ovate-lanceolate, acuminate, 1–2 × 0.4–0.6cm. *Flowers* c.1.5 × 1.5cm, white, sepals tipped with green, lip violet at base, callus bright yellow; pedicel and ovary 0.5–1.2cm long. *Sepals* elliptic to ovate-elliptic, spreading, pilose, c.1 × 0.5cm. *Petals* spathulate, rhombic, obtuse, 0.7–1 × 0.4–0.6cm. *Lip* 3-lobed, base cuneate; lateral lobes linear-oblong, 1–1.5 × 0.6–1cm (across apical lobes); mid-lobe flabellate-oblong, deeply 2-lobed with subrhombic segments, margins entire to erose; callus basal, large, 3- to 5-lobed; spur filiform, curved-clavate, 0.8–1cm long. *Column* very short. *Fruit* narrowly ellipsoid, c.2 × 0.8cm. **Plate 10.**

Bhutan: S – Chukka district (N of Marichong); C – Punakha district (Punakha Valley (field record)); **Terai** (unlocalised *Hooker* specimen); **Sikkim** (Rangit). In hot, tropical valleys, among grass at base of rocks, in riverine forest; 660–1600m. Fl. May–July.

GENERAL DISTRIBUTION. NE India, Japan and Taiwan.
ETYMOLOGY. From the Greek *Alisma* (*Alisma plantago-aquatica*, the water-plantain) and the Latin *folium* (leaf).
NOTE. The leaves of this species are characteristically broadly elliptic-ovate.

2. **C. alpina** Hook. f. ex Lindl., Fol. Orchid. Calanthe 6,7: 4, no.8 (1855). Type: India, Sikkim, Lachen, *Hooker* 245 (holo. K-LINDL!, iso.K!).

Calanthe fimbriata Franchet in Nouv. Arch. Mus. Hist. Nat. sér.2 10: 86 (1887). Type: China, Sichuan, Moupine, *David* s.n. (holo. P!).
Alismorchis alpina (Hook. f. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).
Calanthe buccinifera Rolfe in J. Linn. Soc., Bot. 29: 318 (1893). Types: China, Hupei, *Pratt* 72/102/686 (syn. K!); *Henry* 6064/7161 (syn. K!); Szechuan (Sichuan), *Faber* 953 (syn. K!).
C. schlechteri Hara in J. Jap. Bot. 9: 122 (1933). Type from Japan.
C. fimbriatomarginata Fukuyama in Bot. Mag. (Tokyo) 48: 301 (1934). Type from Taiwan.
C. alpina var. *fimbriata* (Franchet) F. Maekawa, Wild Orchids of Japan in Colour: 474 (1971).

Plant 21–40cm tall; *roots* fasciculate, thick, fibrous. *Pseudobulbs* conical-ovoid, 1.5–2 × 0.9–1.1cm. *Leaves* 3–5, oblong-elliptic to elliptic-obovate, acute to acuminate, shortly petiolate, the basal one sheathing, 10–17 × 2.5–7cm; petiole 4–6cm long. *Inflorescence* terminal, laxly 6- to 12-flowered; peduncle sheathed, glabrous, 16–31cm long; sheaths few, distant, oblanceolate, acute to acuminate, appressed, 1.6–3 × 0.3–0.5cm; rachis glabrous, 8–15cm long; floral bracts lanceolate, acute, 3-veined, 1–2 × 0.2–0.4cm. *Flowers* unscented, 1.5–2cm across; sepals, petals and spur green with white-yellow blotching to pinkish-purple, lip yellow-green with red-purple striations; pedicel and ovary clavate, glabrous, 1.2–2cm long. *Sepals* subsimilar, lanceolate-ovate, acute to acuminate, 0.9–1.3 × 0.4–0.5cm.

Petals lanceolate, acute to acuminate, 0.9–1.3 × 0.4–0.5cm. *Lip* simple, adnate to column base forming a small tube, shortly clawed, spurred, 0.6–0.8 × 0.6–0.9cm; broadly ovate-orbicular, ecallose, margins deeply fimbriate; *spur* slender, curved, 1–2.5cm long. *Column* winged, 3–5mm long. *Fruit* ellipsoid, beaked, 1.8–2 × 0.8–1cm.

Bhutan: C – Thimphu (Motithang, above Thimphu Hospital), Punakha (S side of Tang Chu, Tinlegang (field record), Wangdi Phodrang), Tongsa (Chendebi to Pele La, Shing Jakpa La, Tibde La) and Bumthang (Bumthang) districts; **Sikkim** (Chunthang, Lachen Valley). In pine/fir/spruce and dense mixed forest, on mossy banks in *Rhododendron falconeri* forest; 2500–4000m. Fl. May–July.

GENERAL DISTRIBUTION. Nepal, NE India.
ETYMOLOGY. From the Latin *alpinus* (of mountain pastures).
NOTES. *C. alpina* is closely related to the Chinese *C. fimbriata* which is supposed to differ mainly in having pinkish-purple perianth segments. The flowers of *C. alpina* in Bhutan seem to be locally variable in colour with the perianth segments either greenish or pinkish-purple. Having examined a number of Chinese specimens of *C. fimbriata* the only consistent difference is the colour and we consider these taxa to be conspecific.

3. **C. biloba** Lindl., Fol. Orchid. Calanthe 6,7: 3, no.5 (1854). Type: India, Sikkim, *Hooker* 246 (holo. K-LINDL!, iso. K!).
Calanthe biloba var. *obtusata* Parish & Rchb. f. in Trans. Linn. Soc. London 30: 144 (1874) Type: Burma (Myanmar), Tenasserim, *Parish* 254 (holo. K!, icon. Parish K!).
C. biloba var. *diptera* Hook. f., Fl. Brit. India 5(2): 848 (1890). Type: India, Naga Hills, *Prain* 72 (holo.K!).
C. biloba var. *treutleri* Hook. f., loc. cit. (1890). Type: India, Sikkim, *Treutler* 1155 (holo. K!), **syn. nov.**
Alismorchis biloba (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

Plant 50–70cm tall; *roots* fasciculate, thickly fibrous. *Pseudobulbs* stout, cylindric, 4–12 × 0.5–0.6cm. *Stem* covered by leaf sheaths, 12–18cm long. *Leaves* 3 or 4, unequal, from apex of stem, broadly elliptic, caudate-acuminate, margins undulate, petiolate, 12–30 × 5–11cm; petiole 15–21cm long. *Inflorescence* terminal, subdensely to densely many-flowered; peduncle pubescent, sheathed, 20–35cm long; sheaths lanceolate, acuminate, 3–3.5 × 0.4–0.8cm; rachis pubescent, 16–22cm long; floral bracts linear-lanceolate, acuminate, 2–4 × 0.1–0.4cm. *Flowers* 2–3.5cm across; sepals and petals yellow-ochre spotted with purple-brown, lip pale violet, whitish at base, spur pink; pedicel and ovary linear, 1.5–2cm long. *Sepals* subsimilar, spreading, broadly ovate-lanceolate, caudate-acuminate, 1.4–1.7 × 0.8–1.2cm; *lateral sepals* falcate. *Petals* oblong, apex widely triangular, 1–1.2 × 0.4–0.6cm. *Lip* simple, clawed, spurred, 1.3–1.9cm long; broadly ovate-oblong, deeply 2-lobed; lobes sub-rhombic, acute, deflexed, margins undulate; sinus narrow, apiculate; *spur* conical, c.2mm long. *Column* c.2mm long. *Fruit* ellipsoid, c.3 × 1.5cm.

Bhutan: S – Gaylegphug district (Rani Camp towards Tama (M.F.B.)); C – Punakha district (Tinlegang); **Darjeeling** (Kurseong, Mongpu, Rishap, Sureil); **Sikkim** (Khechoiperi Lake, Rimbi Chhu; unlocalised *Hooker* and *Pantling* specimens). 1000–2800m. Fl. September–November(–December).

GENERAL DISTRIBUTION. Nepal, NE India, SW China and Myanmar.
ETYMOLOGY. From the Latin *bi-* (two) and *lobus* (lobed) in reference to the lip.
NOTES. *C. biloba* is an autumn-flowering species with a clawed lip lacking lateral lobes. The species is variable, particularly in flower size. Seidenfaden (1975a) treated var. *obtusata* in the synonymy of *C. biloba*; we have examined the type material of the other varieties listed above and do not consider that the differences justify varietal status.

4. **C. brevicornu** Lindl., Gen. Sp. Orchid. Pl.: 251 (1833). Type: Nepal, Sheopore, coll. *Wallich* Wall. Cat. 7338 (holo. K-LINDL!, iso. K-W!).
Calanthe brevicornu var. *wattii* Hook. f., Fl. Brit. India 5(2): 848 (1890), **syn. nov.** Type: India, Manipur, Jopoo, *Watt* 6898 (holo. K!).

Alismorchis brevicornu (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

Calanthe lamellosa Rolfe in Bull. Misc. Inform. Kew 1896: 197 (1896). Type: China, Hupeh, *Henry* 5958 (holo. K!).

C. yunnanensis Rolfe in J. Linn. Soc., Bot. 36: 27 (1903). Type: China, Yunnan, *Hancock* 589 (syn. K!) and *Henry* 11107 (syn. K!).

C. scaposa Z.H. Tsi & K.T. Lang in Acta Phytotax. Sin. 23(5): 385 (1985). Type: China, Xizang, Mèdong, *B.S. Li & S.Z. Cheng* 5216 (holo. PE).

Plant 30–56cm tall; *roots* fasciculate, thickly fibrous. *Pseudobulbs* small, ovoid, pointed, c.2 × 1.5cm. *Leaves* 3 or 4, petiolate when mature, ovate-elliptic, acute to acuminate, 19–28 × 5–6.2cm; petiole 12–18cm; basal sheathing leaves 4–6cm long. *Inflorescence* terminal, laxly 8- to 15-flowered; peduncle softly puberulous, sheathed, 18–30cm long; sheaths distant, appressed, lanceolate, acute, c.1.5 × 0.4cm; rachis puberulous, 18–28cm long; floral bracts pubescent at base, lanceolate, acute to acuminate, 1.5–2 × 0.2–0.4cm. *Flowers* spreading, 3–4cm across, brick-red to purple, striped with white or yellow, lip paler purple, striped maroon or yellow; pedicel and ovary linear, pubescent, 1.5–2cm long. *Sepals* similar, spreading, lanceolate to ovate-lanceolate, acute, 1.5–2 × 0.3–0.5cm. *Petals* shorter than the sepals, lanceolate, acute, 1.4–1.7 × 0.3–0.4cm. *Lip* 3-lobed, adnate to column base, shortly spurred, c.1.2 × 0.8cm (at base); lateral lobes oblong, obtuse, diverging; mid-lobe broadly ovate, apex emarginate-apiculate, margins undulate, clawed at base, with 3 fleshy lamellae from mid-lobe base, enlarging towards apex; *spur* broad, obtuse, straight, mouth with retroflexed hairs, 1.5–3mm long. *Column* c.3mm long. *Fruit* ellipsoid, c.2.5 × 1.5cm. **Plate 10.**

Bhutan: S – Chukka district (S of Chima Kothi); **C** – Punakha district (Punakha); **Darjeeling** (between Ghoom and Lopchu, Kalimpong, Senchal); **Sikkim** (Rimbi Chhu; unlocalised *Clarke, Hooker, King* and *Pantling* specimens). In woods and roadside banks; 1660–2660m. Fl. May–June.

GENERAL DISTRIBUTION. Nepal, NE India and Myanmar.

ETYMOLOGY. From the Latin *brevis* (short) and *cornu* (horn, spur). 28

NOTE. Var. *wattii* Hook. f. was distinguished on the basis of having '3 small conical lamellae on the disc of the mid-lobe'. We have examined the type material, and a wide variety of additional material of *C. brevicornu*, and find that the lamellae are variable and that the variety is not worth maintaining.

5. C. chloroleuca Lindl., Fol. Orchid. Calanthe 6,7: 10 no.36 (1855). Type: India, Sikkim, *Hooker* 244 (holo. K-LINDL!).

Calanthe galeata Lindl., Fol. Orchid. Calanthe 6,7: 5 no.10 (1855). Type: India, Darjeeling, icon. Hooker (holo. K-LINDL!).

Alismorchis chloroleuca (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

Plant 30–60cm tall; *roots* fasciculate. *Pseudobulbs* conical-ovoid to cylindric, 1–2 × 1.5–2cm. *Leaves* 2–4, sheathing at base when young, finally elliptic to elliptic-lanceolate, acute, petiolate, 17–20 × 4–9cm; petiole grooved, 11–15cm long. *Inflorescence* terminal, laxly few- to many-flowered; peduncle puberulent, sheathed, 23–30cm long; sheaths triangular-lanceolate, acute, appressed, 8–9 × 4–5mm; rachis puberulent, 4–27cm long; floral bracts lanceolate, acute, c.7 × 2mm. *Flowers* fragrant, 2–3cm across; sepals and petals yellow-green, lip white with yellow in middle; pedicel and ovary pubescent, 2.2–2.5cm long. *Sepals* subsimilar, ovate-lanceolate to elliptic-lanceolate, spreading, 1.4–1.7 × 0.4–0.6cm. *Petals* oblanceolate, obtuse to subacute, 1.3–1.5 × 0.3–0.4cm. *Lip* 3-lobed, adnate to column base, spurred, 1.2–1.4 × 0.9–1.1cm (when spread); lateral lobes broadly oblong, divergent; mid-lobe broadly ovate, 2-lobulate, margins erose; disc at base with 2 short calluses; *spur* stout, straight, obtuse to subclavate, puberulent, 0.8–1.2cm long. *Column* broad, 3–5mm long. *Fruit* ovoid, stalked, 3–3.8 × 1.4–1.6cm.

Bhutan: S – Chukka district (Chima Kothi, near Mathur Bridge); **C** – Punakha (Ritang, between Samtengang and Ritang, near Tinlegang), Tongsa (near Tongsa) and Mongar (between Pimi and

Rudong La, W side of Donga La) districts; **N** – Upper Mo Chu (Gasa, Mishichen to Tamji) and Upper Kuru Chu (between Dengchung and Khoma Chu) districts; **Darjeeling** (between Bhotia Basti and Budhwari, Victoria Fall?); **Sikkim** (unlocalised *Hooker* and *Treutler* specimens). On mossy banks in *Rhododendron* and dense forest; 660–3000m. Fl. April–May.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Greek *chloros* (greenish-yellow) and *leucon* (white) in reference to the flower colour.
NOTES. Lindley described *C. galeata* based on a drawing by Hooker of a plant collected in Darjeeling. This drawing is identical to plants of *C. chloroleuca* and we treat it as conspecific. King & Pantling (1898) described the fragrance as resembling that of primroses.

6. **C. fulgens** Lindl., Fol. Orchid. Calanthe 6,7: 10 no.37 (1855). Type: India, Sikkim, *Hooker* 248 (holo. K-LINDL!).
Calanthe masuca var. *fulgens* (Lindl.) Hook. f., Fl. Brit. India 5(2): 851 (1890).

Plant 25–45cm tall. *Pseudobulbs* ovoid-conical, 1.5–2 × 1.5–1.8cm. *Leaves* 2 or 3, broadly elliptic, acute to acuminate, petiolate, glabrous, 21–32 × 9–12cm; petiole 12–14cm long; basal leaves 3 or 4, sheathing, 14–19cm tall. *Inflorescence* terminal, subcapitate, 3- to 7-flowered; peduncle puberulent, ridged, sheathed, 25–35cm long; sheaths distant, appressed, lanceolate, acute, c.1.5cm long; rachis densely pubescent, 3–5cm long; floral bracts lanceolate-ovate, acute, pubescent externally, 0.8–1 × 0.3–0.4cm. *Flowers* 3–4cm across; sepals and petals crimson-maroon with yellow base, lip deep purple, base with 2 yellow streaks; pedicel and ovary puberulent, 1.8–2.6cm long. *Sepals* subsimilar, ovate-lanceolate, acute to acuminate, c.1.8 × 0.7cm; *lateral sepals* weakly falcate. *Petals* oblong-elliptic, obtuse, 1.3–1.4 × c.0.5cm. *Lip* 3-lobed, adnate to column base, long spurred, ecallose, c.1 × 0.6cm; lateral lobes ovate, subacute; mid-lobe 2-lobed, lobes subquadrate, ovate-lunate, weakly undulate to entire; *spur* puberulent, curved, 1.5–2cm long. *Column* 5–6mm long. *Fruit* ellipsoid, beaked, pendent, c.2.5 × 1cm. 286
Sikkim (unlocalised *Hooker* specimen). In hot valleys; 660–1000m.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *fulgens* (shining, bright) in reference to the flowers.
NOTES. This species is related to *C. chloroleuca* and *C. herbacea* but has a subcapitate inflorescence, a long spur and bright crimson-purple flowers. Hooker (1890) reduced it to a variety of *C. masuca* (now *C. sylvatica*) but it is distinct from that species in being a smaller plant with an ecallose lip base.

7. **C. griffithii** Lindl. in Paxton's Fl. Gard. 3: 37 (1852–53). Types: Bhutan, Chuka, *Griffith* 33 (syn. K-LINDL!); Telagong, *Griffith* s.n. (syn. K-LINDL!).
Calanthe plantaginea sensu Griff., Not. Pl. Asiat. 3: 368 (1851), non Lindl.
Alismorchis griffithii (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).
Calanthe tangmaiensis K.Y. Lang & Y. Tateishi in Acta Phytotax. Sin. 30(6): 563 (1992). Type: China, Xizang, Tangmai, *T. Naito* s.n. (holo. PE).
C. anjanii S.Z. Lucksom in Indian J. Forest. 16(4): 386 (1993), **syn. nov.** Type: India, Sikkim, Fimphu, *S.Z. Lucksom* 206A,B,C,D (holo. CAL, iso. BSHC).

Plant 30–60cm tall. *Pseudobulb* conical, c.1cm tall. *Leaves* 4–7, sheathing at base when young, elliptic-lanceolate to oblong-lanceolate, acute, 7–20 × 2.5–5cm. *Inflorescence* terminal, laxly 8- to 15-flowered; peduncle glabrous to very finely puberulent, sheathed, 14–22cm long; sheaths lanceolate, acute, appressed, c.7mm long; rachis finely puberulent, 9–30cm long; floral bracts boat-shaped, lanceolate, acute to acuminate, glabrous, 0.8–1 × 0.15–0.3cm. *Flowers* 2.5–3.5cm across; sepals and petals greenish-brown to yellow-green, lip yellow-ochre to cream-yellow; pedicel and ovary puberulent, 1.7–2.3cm long. *Sepals* similar, elliptic, acuminate, 1.5–1.7 × 0.4–0.5cm. *Petals* oblong-elliptic, acute, 1–1.2 × 0.2–0.4cm. Lip 3-lobed, adnate to column base; lateral lobes oblong to spathulate, rounded, c.6mm long; mid-lobe broadly triangular, apex emarginate with an apiculus, margins undulate, 6–7 × 5–7mm (at base when spread); callus on mid-lobe keeled, single, large, expanded in the middle, 1–2mm tall; spur puberulent, 4.5–6.5mm long. *Column* c.5mm long.

Bhutan: S – Chukka district (Chukka); C – Punakha district (3km above Menchunang, Tinlegang); **Darjeeling** (unlocalised Griffith specimen); **Sikkim** (Lachen Valley, Lachung Valley). On wet banks, in shady moist sites, in evergreen *Quercus lamellosa* forest; 2000–3000m. Fl. April–July.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named after William Griffith (1810–1845) who was the first Westerner to collect plants in Bhutan.

NOTES. Hooker (1890) pointed out that the large solitary callus was characteristic of this species.

Lucksom described *C. anjanii* which he compared with *C. chloroleuca*. We have not seen the type material of this species, but it appears to be much closer to *C. griffithii*, particularly with regard to the characteristic keeled callus on the mid-lobe of the lip, and we tentatively include it within synonymy.

8. **C. herbacea** Lindl., Fol. Orchid. Calanthe 6,7: 10, no.34 (1855). Type: India, Sikkim, icon. Cathcart s.n. (holo. K!, copy K-LINDL!).

Calanthe erythroglossa Rchb. f. ex Hook. f., Fl. Brit. India 5(2): 853 (1890), **syn. nov.** Types: India, Sikkim, *Treutler* 537 (syn. K!); Sikkim, Rungbee (Rimbi Chhu), *Clarke* 8621, 12320 (syn K!).

Alismorchis herbacea (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

Plant 50–65cm tall; *roots* fasciculate, 1–2mm thick. *Pseudobulbs* short, fusiform, curved, c.1 × 0.5cm; internodes c.5. *Leaves* 3–5, broadly to narrowly elliptic, acuminate, petiolate, 18–25 × 5.5–10cm; petiole 9–22cm long. *Inflorescence* terminal, laxly 6- to 20-flowered; peduncle sheathed, pubescent, ridged, 30–42cm long; sheaths oblong-ovate, acute, appressed, distant, c.1.7 × 0.5cm; rachis pubescent, 11–17cm long; floral bracts lanceolate, acute, pubescent at base externally, 13–15 × 1.5–2.5mm. *Flowers* not fragrant, 2–3cm across; sepals and petals green, lip white, callus yellow; pedicel and ovary long, pubescent, 2.2–2.9cm long. *Sepals* elliptic to obovate-elliptic, subacute, spreading, 1.1–1.3 × 0.4–0.5cm. *Petals* oblong-elliptic, subspathulate, reflexed, 1.1–1.3 × 0.3–0.5cm. *Lip* 3-lobed, adnate to the column, 0.9–1 × 1.2–1.6cm (at base when spread); lateral lobes narrowly oblong; mid-lobe broadly triangular, 2-lobulate, emarginate at apex, lobules diverging, oblong, falcate; callus warty, triangular; spur slender, sigmoid, 2.2–2.5cm long. *Column* long; stigma divided into two by the spur, 6–7mm long. *Fruit* ovoid, long-stalked, 2–3 × 1.2–1.6cm.

Darjeeling (Daling); **Sikkim** (Rimbi Chhu). 1330–2600m. Fl. June–August.

GENERAL DISTRIBUTION. NE India, S China and Vietnam.

ETYMOLOGY. From the Latin *herbaceus* (herbaceous, green or yellow-green in colour).

NOTES. King & Pantling (1898) commented that this species was closely related to *C. chloroleuca* but differed in lacking fragrance, having a longer spur and apical lobes of the lip that are entire, oblong and divergent rather than crenate, rounded and parallel.

C. erythroglossa was described by Hooker (1890); the type specimens (at K) have been examined and are found to be identical with *C. herbacea*.

9. **C. keshabii** S.Z. Lucksom in Indian J. Forest. 15(2): 136 (1992). Type: India, Sikkim, Chungthang valley, *S.Z. Lucksom* 205A (holo. CAL!).

Calanthe alpina var. *keshabii* (S.Z. Lucksom) R.C. Srivastava in Novon 8(2): 203 (1998).

Plant 17–30cm tall; *rhizome* stout, smooth. *Pseudobulbs* ovoid, 1.5–3.5 × 1–2.5cm. *Leaves* 3 or 4, unequal, elliptic-lanceolate, acute, petiolate, 18–25.5 × 5–7.5cm; petiole 6–9cm long. *Inflorescence* 4- to 10-flowered; peduncle sheathed, 14–25.5cm long; sheaths spathulate, 1–2cm long; rachis 3.5–7cm long; floral bracts (0.9–)1.4–1.8 × 0.6–0.67cm. *Flowers* pendent, 2–3.5cm across, whitish-purple;

pedicel and ovary curved, 1.2–2cm long. *Sepals* subequal, elliptic-oblong, slightly concave, acuminate, 5-veined, spreading; dorsal sepal 1.4–1.8 × 0.5–0.8cm; lateral sepals falcate, 1.9–2 × 0.7–0.8cm. *Petals* linear-oblong, involute, subacute, 1.4–1.5 × c.0.2cm. *Lip* shortly clawed, 3-lobed, spurred, 1.1–1.4 × 0.8–1.1cm; lateral lobes falcately oblong, obtuse, porrect; mid-lobe narrowly 2-lobulate, margins deeply fimbriate; disc with 2 shallow, longitudinal calluses; *spur* 1.2–1.4cm long. *Column* c.7 × 4mm.

Bhutan: C – Punakha district (Lometsawa); **Sikkim** (Chunthang Valley, Lachen Valley). In warm, moist broad-leaved forest; 2000–2600m. Fl. May–July.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named after Shri Kesab Chandra Pradhan, Advisor to the Government of Sikkim.

NOTES. *C. keshabii* resembles *C. alpina* but differs in having a clearly 3-lobed lip, the mid-lobe is narrowly 2-lobulate and has a disc with 2 longitudinal lamellae. We have examined *Pantling* 388B at Kew formerly included under *C. alpina*, but its lip is 3-lobed and it thus belongs to *C. keshabii*.

10. **C. mannii** Hook. f., Fl. Brit. India 5(2): 850 (1890). Types: India, W Himalaya, *Duthie* 5996 (syn. K!); Khasia Hills, Mairang, *Mann* s.n. (syn. K!); E Khasia Hills, *Clarke* 49321 (syn. K!).

Alismorchis mannii (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

Calanthe pusilla Finet in Bull. Soc. Bot. France 46: 436 (1899). Type: China, Sutchuen, *Farges* s.n. (holo. P).

C. brachychila Gagnepain, op. cit. 79: 162 (1932). Type from Vietnam.

Plant 30–45cm; *roots* fasciculate, thick and fibrous. *Pseudobulbs* short, cylindric, 1–2.5cm long. *Leaves* 4 or 5, narrowly elliptic-oblong to oblanceolate-oblong, acute to subacute, petiolate, 14–30 × 2–4cm, the lower 2 sheathing at base; petiole 8–9cm. *Inflorescence* terminal, laxly 10- to 20-flowered; peduncle pubescent, sheathless, 20–28cm long; rachis pubescent, 7–18cm long; floral bracts glabrous, small, lanceolate, acute, 2–4 × 0.5–1mm. *Flowers* deflexed, 0.5–1cm across, pale green to dull brown, lip yellow; pedicel and ovary pubescent, clavate, 5–9mm long. *Sepals* similar, ovate-oblong, acute, pubescent externally, 6–7 × 2–2.5mm. *Petals* ovate-oblanceolate, acute, glabrous, 5–6 × 1.6–2mm. *Lip* 3-lobed, shortly spurred, adnate to column base, 4–5 × 2–3mm; lateral lobes large, broadly ovate, truncate, erect; mid-lobe deflexed, subreniform, margins entire, emarginate; 3-lamellate from base to apex, expanding to semi-lunate swellings, tuberculate; *spur* pubescent, conical, 1–2mm long. *Column* short, stout, 1–3mm long. *Fruit* fusiform, pendent. **Plate 10.**

Bhutan: C – Punakha (between Punakha and Tinlegang, Samtengang) and Tashigang (Chorten Kora, near Shali (M.F.B.), between Shapang and Tashi Yangtsi) districts; **N** – Upper Kulong Chu district (Tobrang (M.F.B.)); **Sikkim** (Chunthang). In dense rain forest, under *Viburnum* sp.; 600–2100m. Fl. (March–)May–June.

GENERAL DISTRIBUTION. NE India, China (Sichuan), Vietnam and Myanmar.

ETYMOLOGY. Named after Gustav Mann (1836–1916), a German botanist, Kew gardener and plant collector who worked for the Indian Forest Service between 1863 and 1891.

11. **C. odora** Griff., Not. Pl. Asiat. 3: 365 (1851). Type: India, Upper Assam, Suddyah, *Griffith* 477 (holo. K, probably lost); Lectotype: Upper Assam, icon. (W! Herb. no. 21958, designated by M.A. Clements in Australian Orchid Research 1: 32 (1989)).

Calanthe angusta Lindl., Fol. Orchid. Calanthe 6,7: 7, no.21 (1854). Type: India, Khasia, *Lobb* s.n. (holo. K-LINDL!, iso K!).

Alismorchis angusta (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

A. odora (Griff.) Kuntze, loc. cit. (1891).

Plant 26–55cm tall; *roots* fasciculate. *Pseudobulbs* ovoid-conical, caespitose, 1.5–2 × 0.6–0.8cm. *Leaves* 3 or 4, from pseudobulb, narrowly elliptic to oblong-elliptic, acute, bases sheathing, subsessile, 11–25 × 2–6cm. *Inflorescence* terminal, densely to subdensely few- to many-flowered; peduncle sheathed, puberulous, 9–35cm long; sheaths several, distant at 4–8cm, lanceolate-ovate, acute, 1–4 × 0.6–0.8cm; rachis puberulous, 6–15cm long; floral bracts broadly elliptic, acute to subacute, minutely puberulous at base, 0.9–2 × 0.3–0.6cm. *Flowers* sweetly fragrant, 0.9–2cm across, uniformly white; pedicel and ovary puberulous, 0.6–1cm. *Sepals* similar, elliptic-ovate, subacute, spreading, 0.7–1.1 × 0.4–0.5cm. *Petals* narrowly oblong, obtuse, 7–9 × 3–5mm. *Lip* 3-lobed, spurred, 0.8–1 × 0.6–0.8cm (when spread); lateral lobes large, oblong, weakly falcate, obtuse, apices convergent; mid-lobe subreniform, divided into 2 large, subobovate, obtuse lobes, separated by a deep triangular sinus; callus at base a semi-circular cluster of tuberous-warty lumps in front of the spur; spur slender, cylindric, curved-clavate, 7–9mm long. *Column* 2–3mm long.

Duars (E of Jaldacca River); **Darjeeling** (Bhotia Basti). 260–2000m. Fl. April.

GENERAL DISTRIBUTION. N India, China, Cambodia, Laos and Vietnam.
ETYMOLOGY. From the Latin *odorus* in reference to the fragrant flowers.
NOTES. Chen & Tsi (1998) reduced *C. angusta* to synonymy under *C. odora* Griff. Tsi (pers. comm.) based this transfer on work undertaken by Professor Tang during a visit to Europe between 1926 and 1927. *C. odora* has recently been treated within the synonymy of *C. triplicata*, an untenable position because of the fragrant flowers. Despite the lack of the type material we feel that the protologue enables us to support this treatment and therefore follow Chen & Tsi here.

12. **C. plantaginea** Lindl., Gen. Sp. Orchid. Pl.: 250 (1833). Types: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 7346A (syn. K-LINDL!, isosyn. K-W!); India, Kamaon, coll. R. *Blinkworth* Wall. Cat. 7346B (syn. K-LINDL!, isosyn. K-W!).

Plant 30–50cm tall; *roots* caespitose. *Pseudobulbs* conical, 1.5–2 × 1–1.5cm. *Leaves* 3, from apex of pseudobulb, elliptic-ovate, acute, prominently ridged, petiolate, developing with the flowers, 19–30 × 4–8cm; petiole grooved, 8–23cm long. *Inflorescence* lateral from pseudobulb, laxly to subdensely many-flowered; peduncle ridged, puberulent, sheathed, 15–24cm long; sheaths small, distant, triangular, acute, membranous, c.6 × 3mm; rachis puberulent, 10–12cm long; floral bracts small, lanceolate, acute, c.7 × 1.5mm. *Flowers* fragrant, pendent, 3–4cm across; sepals and petals purple-white externally, cream within, lip purple, base yellow; pedicel and ovary pubescent, 2–3.3cm long. *Sepals* subsimilar, lanceolate-ovate, acute, 5-veined, 1.2–1.5 × 0.6–0.7cm; *lateral sepals* spreading. *Petals* lanceolate, acute, 5-veined, spreading, 1.3–1.5 × 0.4–0.5cm. *Lip* 3-lobed, adnate to column, 0.9–1.1 × 1.1–1.3cm (across lateral lobes when spread); lateral lobes subquadrate to obovate-falcate, truncate; mid-lobe expanded from base, spathulate to weakly trowel-shaped, margins entire; callus 3-ridged, extending to base; spur pubescent, long, cylindric-filiform, 2.5–3cm long. *Column* c.8mm long. *Fruit* ovoid, stalked, 3.2–4 × 1.5–1.8cm; stalk c.1.5cm long.

Bhutan: S – Chukka (Chima Kothi, Mathur Bridge), **Gaylegphug** (Rani Camp (M.F.B.)) and **Deothang** (Kheri Gompa) districts; **C – Punakha** (Nahi, above Punakha, Samtengang to Ritang, Tinlegang (field record)), **Punakha/Tongsa** (Pele La (F.E.H.2)), **Tongsa** (Chendebi to Changkha, Kinga Rapden, below Shemgang, near Tashiling), **Mongar** (Lingitsi) and **Tashigang** (near Shali (M.F.B.)) districts; **Sikkim** (Lachen Valley, Lachung). On forest slopes in evergreen oak forest, on damp ground in dense shady broad-leaved forest; 1400–2600m. Fl. February–April(–June).

GENERAL DISTRIBUTION. Nepal, NE India.
ETYMOLOGY. From the Latin *plantagineus* (plantain-like), a reference to the similarity of the leaves to those of the European plantain (*Plantago*).

13. **C. puberula** Lindl., Gen. Sp. Orchid. Pl.: 252 (1833). Type: ?India, Mt. Sylhet, coll. *F. De Silva* Wall. Cat. 7342 (holo. K-W!).
Alismorchis puberula (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

Calanthe amoena W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 13: 191 (1921). Type: China, Yunnan, *Forrest* 8867 (holo. E!).

C. lepida W.W. Smith, op. cit. 192 (1921). Type: China, SE Xizang, *Forrest* 19063 (holo. E!).

Paracalanthe reflexa var. *puberula* (Lindl.) Kudo in J. Soc. Trop. Agric. 2: 236 (1930).

Plant 25–60cm tall; roots clustered, thick, fibrous. *Pseudobulbs* ovoid-conical, 2–4 × c.1cm. *Leaves* 5–7, unequal, elliptic to elliptic-oblong, acuminate, petiolate, lower leaves sheathing at base, 6–24 × 3–7cm; petiole 7–10cm long. *Inflorescence* terminal, laxly few- to many-flowered; peduncle puberulous, sheathed, 17–25cm long; sheaths widely distant, clasping, lanceolate, acuminate, c.2 × 0.4cm; rachis puberulous, 10–12cm long; floral bracts prominent, lanceolate, acuminate, puberulous, 1.5–2.5 × 0.3–0.5cm. *Flowers* puberulous externally, c.2cm across, pale lavender, lip mauve with a white base, column white with purple and yellow markings; pedicel and ovary linear, 1.5–3cm long. *Sepals* similar, spreading, ovate-lanceolate, weakly falcate, acuminate, 1–1.6 × 0.4–0.5cm. *Petals* linear-oblong, weakly falcate, acuminate, 1–1.2 × c.0.1cm. *Lip* 3-lobed, adnate to column base, spurless, 1–1.5 × 0.6–1cm; lateral lobes oblong, falcate, obtuse; mid-lobe clawed at base, ovate-orbicular, long-apiculate, margins erose-undulate; disc with 2 narrow calluses at base. *Column* thick, c.4 × 3mm (at base). *Fruit* ellipsoid, c.3 × 1.4cm.

Bhutan: C – Punakha (Rimchu, Tinlegang (field record)) and Tongsa (Shemgang (M.F.B.)) districts; **N** – Upper Mo Chu district (Gasa); **Darjeeling** (Bhotia Basti, Budhwari, 12km above Mungpu, Pankhabari, Sitong); **Sikkim** (Lachen Valley). On moist rocks, in degraded evergreen oak forest; 1650–3000m. Fl. (May–)July–August.

GENERAL DISTRIBUTION. N India, Nepal, China, Japan and Vietnam.

ETYMOLOGY. From the Latin *puberulus* (minutely pubescent, with short soft hairs) referring to the flowers.

14. C. sylvatica (Thouars) Lindl., Gen. Sp. Orchid. Pl.: 250 (1833). Type: Mascarene Islands, *du Petit-Thouars* s.n. (holo. P!).

Centrosis sylvatica Thouars, Hist. Orchid.: t.35, 36 (1822).

Amblyglottis emarginata Bl., Bijdr.: 370 (1825). Type from Java.

Bletia masuca D. Don, Prodr. Fl. Nepal: 30 (1825). Type: Nepal, *Buchanan-Hamilton* s.n. (holo. BM!, iso. LINN! Herb. no. 1403.11.1!).

Zoduba masuca Buchanan-Hamilton ex D. Don, loc. cit. (1825), nom. nud.

Calanthe masuca (D. Don) Lindl., Gen. Sp. Orchid. Pl.: 249 (1833).

C. emarginata (Bl.) Lindl., loc. cit. (1833).

C. versicolor Lindl., Sert. Orchid.: t.42 (1838). Type: E Indies, without provenance, cult. Syon (holo. K-LINDL!).

C. emarginata sensu Wight, Icon. Pl. Ind. Orient. 3: t.918 (1845), non (Bl.) Lindl.

C. wightii Rchb. f. in Walpers, Ann. Bot. Syst. 6: 932 (1861). Type: India, Madras, *Wight* s.n. (holo. K!).

C. textorii Miquel, Ann. Mus. Bot. Lugduno-Batavi 2: 204 (1866). Type from Japan.

Alismorchis masuca (D. Don) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

A. emarginata (Bl.) Kuntze, loc. cit. (1891).

Calanthe celebica Rolfe in Bull. Misc. Inform. Kew 1899: 129 (1899). Type from Sulawesi.

C. longicalcarata Hayata ex Yamamoto in Trans. Nat. Hist. Soc. Taiwan 20: 39 (1930). Type from Taiwan.

C. seikooensis Yamamoto in J. Soc. Trop. Agric. 3: 237 (1931). Type from Taiwan.

C. kintaroi Yamamoto, op. cit. 6: 550 (1934). Type from Taiwan.

C. albolongicalcarata S.S. Ying in Bull. Exp. Forest Natl. Taiwan Univ. 114: 155 (1974). Type from Taiwan.

Plant erect, 50–65cm tall. *Pseudobulbs* narrowly conical-cylindric, 4- or 5-noded, 1.5–5cm tall. *Leaves* 2–4, large, broadly elliptic, acute to acuminate, petiolate, 24–40 × 7–12.5cm; petiole grooved, 10–17cm long. *Inflorescence* terminal, laxly few- to many-flowered; peduncle pubescent, sheathed, 20–30cm long; sheaths lanceolate, acute, 2–2.5cm long; rachis pubescent, 7–17cm long; floral bracts ovate-lanceolate, concave, pubescent externally, 1.2–2 × 0.4–0.5cm. *Flowers* 2–4cm across, uniformly violet-purple to white, calluses yellow; pedicel and ovary pubescent, 2–3.1cm long. *Sepals* subsimilar, broadly ovate-elliptic, acute, 1.3–3.5 × 0.4–1.2cm; dorsal sepal 7-veined; lateral sepals 5-veined. *Petals* elliptic-ovate, acute, 1.3–2.6 × 0.5–0.7cm. *Lip* 3-lobed, adnate to the column base, spurred, 1–2.5 × 0.8–2cm (at base when spread); lateral lobes oblong-auriculate, obtuse, weakly falcate, porrect; mid-lobe flabellate, wedge-shaped or reniform, emarginate at apex; disc at base with 3 projecting, elongate, warty calluses; spur curved, sigmoid or incurved, 2–4.5cm long. *Column* 3.4–4mm long. *Fruit* ellipsoid, 2–3 × 0.5–1cm.

Bhutan: S – Phuntsholing district (Kamji (M.F.B.)); C – Punakha (Tabjisa) and Mongar (Khoma) districts; **Darjeeling** (Rimbi Chhu, Rishap); **Sikkim** (unlocalised *Hooker* and *King* specimens). In hot valleys, beside streams; 330–2000m. Fl. August–September.

GENERAL DISTRIBUTION. Widespread in Africa, Madagascar, the Mascarene Islands, India, Sri Lanka, China, the Ryukyu Islands and Indonesia.

ETYMOLOGY. From the Latin *sylvaticus* (of woods or forests).

NOTES. Cribb (1984) considered *C. masuca* to be conspecific with *C. sylvatica* and this treatment has been followed by Chan *et al.* (1994) and Seidenfaden (1995a). A full African synonymy can be found in Cribb (1984).

15. **C. tricarinata** Lindl., Gen. Sp. Orchid. Pl.: 252 (1833). Type: Nepal, wthout precise locality, coll. *Wallich* Wall. Cat. 7339 (holo. K-LINDL!, iso. K! K-W!).

Calanthe occidentalis Lindl., Fol. Orchid. Calanthe 6,7: 3, no.3 (1855). Type: NW Himalaya, *Thomson* 237 (holo. K-LINDL!).

C. megalopha Franchet, Pl. David. 2: 123 (1887). Type: China, Szechuan (Sichuan), Moupine (Baoxing), *David* s.n. (holo. P).

Alsimorchis tricarinata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

Calanthe undulata sensu Schltr. in Notes Roy. Bot. Gard. Edinburgh 5: 110 (1912), *non* J.J. Smith.

C. lamellata Hayata, Icon. Pl. Formos. 4: 70 (1914). Type from Taiwan.

C. torifera Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 68 (1919). Type from Japan.

C. pantlingii Schtlr., op. cit. 240 (1919), *nom. nov.*

Paracalanthe tricarinata (Lindl.) Kudo in J. Soc. Trop. Agric. 2: 236 (1930).

Plant 35–50cm tall; *roots* clustered, thickly fibrous. *Pseudobulbs* broadly ovoid, 1–2 × 1–1.5cm. *Leaves* 2–4, elliptic-lanceolate to ovate-oblanceolate, acute, petiolate, overlapping at base, 12–30 × 3–7.5cm; petiole 4–7cm long. *Inflorescence* laxly 5- to 14-flowered; peduncle long, slender, sheathless, 18–30cm long; rachis 12–22cm long; floral bracts lanceolate, acute, 3–5 × 1–1.5mm. *Flowers* showy, 2–3.5cm across; sepals and petals green edged with white, lip orange to orange-red to brown with a yellowish-green base, callus purple, column yellow-white; pedicel and ovary 1.1–1.4cm long. *Sepals* similar, spreading, broadly lanceolate, acute to acuminate, 5- to 7-veined, 1.6–1.8 × 0.7–0.8cm. *Petals* lanceolate, acute, 5- to 7-veined, 1.6–1.8 × 0.5–0.6cm. *Lip* broadly 3-lobed, oblong, decurved, saccate at base, adnate to column, 1.8–2 × 1.2–1.4cm; lateral lobes orbicular, spathulate, acute to subacute; mid-lobe rounded to bifid, margins undulate; disc with a divided, puberulous callus (at base) and 3 prominent, crenulate ridges. *Column* clavate, weakly curved, c.5 × 3mm (at apex). *Fruit* ellipsoid, beaked, 3–4 × 1.5–2cm. **Fig. 65; Plate 11.**

Bhutan: C – Punakha (between Tashi La and Chusom (field record), Wangdi Phodrang (field record)), Punakha/Tongsa (Pele La, Ri-Tang to Pele La), Tongsa (Chendebi, W of Tongsa) and Bumthang (Chumey) districts; N – Upper Kuru Chu (Sergong La) and Upper Kulong Chu (Tobrang) districts. **Sikkim** (Lachen Valley). On damp grassy banks in *Quercus* and mixed forest, in clumps on rotten, fallen tree trunks, on open steep grass slopes, in bamboo scrub; 2000–3600m. Fl. May–June.

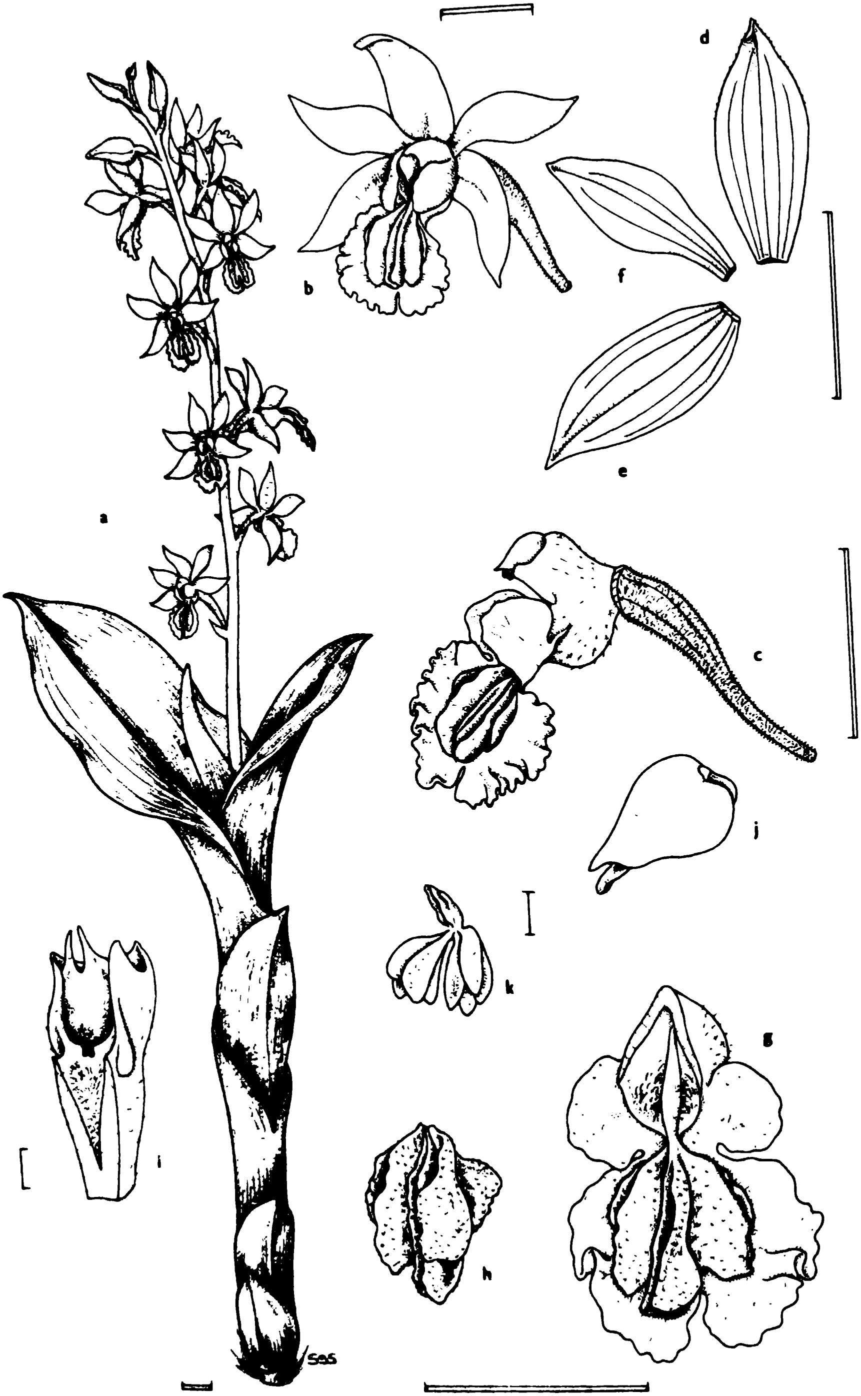


Fig. 65 **Calanthe tricarinata**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip callus (detail); i, column; j, anther; k, pollinarium. Drawn by Susanna Stuart-Smith, a from *Grierson & Long* 1091 (K), b–k from *Gould* 319 (K)

GENERAL DISTRIBUTION. India, Nepal, China, Japan and Taiwan.

ETYMOLOGY. From the Latin *tri-* (three) and *carinatus* (keeled) in reference to the mid-lobe of the lip.

NOTES. *Pantling* 389 consists of two different species: 389A (K) is spurred and has been identified as *C. griffithii*. 389B (BM) is spurless and close to *C. tricarinata*; the disc has a broad, round, raised, obscurely 3-lamellate plate which extends into the basal lobe. From the material available it has proved difficult to decide whether the ornamentations on the disc are sufficiently different from those of *C. tricarinata* to justify describing it as a new species. We leave it in *C. tricarinata* until further collections can clarify the position.

16. *C.* **triplicata** (Willemet) Ames in Philipp. J. Sci. 2: 326 (1907). Holotype: [icon. in] Rumphius, Herb. Amboin. 6: 115, t.52, f.2 (1750)!

Flos triplicatus Rumphius, Herb. Amboin. 6: 115, t.52, f.2 (1750).

Orchis triplicata Willemet in Usteri, Ann. Bot. 18: 52 (1796).

Limodorum veratrifolium Willdenow, Sp. Pl. ed.4(1): 122 (1805). Based on pre-Linnean names.

L. ventricosum Steudel, Nomencl. Bot. ed.1: 481 (1821), *nom. alt.*

Calanthe veratrifolia (Willdenow) Ker Gawler in Bot. Reg. 9: t.720 (1823).

Amblyglottis veratrifolia (Willdenow) Bl., Bijdr.: 370 (1825).

C. perottetii A. Richard in Ann. Sci. Nat. (Paris) sér.2, 15: 68 (1841). Type: India, Nilgiri Hills, *Perrottet* s.n. (holo. P).

C. comosa Rchb. f. in Linnaea 19(3): 374 (1846). Type: India, Nilgiri Hills, *Delessert* s.n. (holo. W! no.42161).

C. proboscidea Rchb. f. in Gard. Chron. n.s. 21: 476 (1884). Type without provenance.

C. matsamurana Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 2: 168 (1906). Type from Japan.

C. brevicolumna Hayata in J. Coll. Sci. Imp. Univ. Tokyo 30(1): 328 (1911). Type from Taiwan.

C. rubicallosa Masamune in J. Geobot. 23(2): t.7 (1975). Type from Taiwan.

Plant 40–100cm tall; *rhizome* stout, short; *roots* caespitose. *Pseudobulbs* ovoid, conical, 1.5–2 × 1–1.5cm. *Leaves* 3–6, ovate-lanceolate to narrowly elliptic-lanceolate, petiolate, ribbed, puberulent below, 20–60 × 4.5–12cm; petiole grooved, 10–20cm long. *Inflorescence* erect, densely many-flowered towards apex; peduncle puberulent, sheathed, 20–40cm long; sheaths lanceolate, acute, 2–4 × 0.5–0.9cm; rachis puberulent, 8–21cm long; floral bracts lanceolate, acute, 1–4 × 0.5–0.9cm. *Flowers* c.5cm long, white with pale green tips to the sepals, callus yellow to red-orange; pedicel and ovary pubescent, 2.5–4.5cm long. *Sepals* similar, elliptic-obovate, apiculate, 1.2–1.5 × 0.6–0.7cm. *Petals* broadly oblong to oblanceolate, apiculate, c.1.3 × 0.5–0.7cm. *Lip* adnate to the column base, spurred, 3-lobed, 1.3–1.8 × c.1.3cm; lateral lobes oblong, obtuse, spreading; mid-lobe deeply divided into 2 linear-oblong, falcately recurved segments, sinus acute; disc tuberculate; spur slender, curved, 1.5–2.5cm long. *Column* puberulent, 5–7mm long. *Fruit* ellipsoid, c.3 × 1.5cm. **Plate 11.**

Bhutan: C – Punakha (between Rimchu and Punakha), Tongsa (Mangde Chu Valley, Tingtinbi), Mongar (between Saling and Mongar) and Tashigang (near Tashi Yangtsi) districts; **Darjeeling** (Chota Rangit River). On rocks, in dense jungle in warm valleys, in leaf-mould in partial shade, on wet S-facing hillsides and growing on *Pothos* sp.; 700–1660m. Fl. April–May; July–December.

GENERAL DISTRIBUTION. India, Sri Lanka, SE Asia, Indonesia, Japan and south to Australia and Fiji.

ETYMOLOGY. From the Latin *triplicatus* (three-folded) in reference to the strongly 3-lobed lip.

NOTES. This species is better known locally by the name *C. veratrifolia*. An extended synonymy can be found in Seidenfaden (1975a) and Lang (1999).

17. *C.* **trulliformis** King & Pantling in J. Asiat. Soc. Bengal 64(3): 337 (1896). Type: India, Darjeeling, on Mahaldiram Peak, *Pantling* 168 (holo. CAL, iso. BM! K!).

Plant 18–60cm tall. *Pseudobulbs* cylindric, c.1.5 × 1cm. *Leaves* 3 or 4, linear-lanceolate, acute, sessile to subsessile, strongly veined below, 12–30 × 1–2.3cm. *Inflorescence* terminal, subdensely many-flowered; peduncle puberulous, sheathed, 20–42cm long; sheaths distant, lanceolate, acute, glabrous, c.3 × 0.4cm; rachis puberulous, 5–16cm long; floral bracts linear-lanceolate, acute, 3–4 × 0.2–0.3cm. *Flowers* c.1.5cm across; sepals and petals chocolate brown, lip white with a triangular pink mark at base, column green; pedicel and ovary puberulous, 1.2–1.8cm long. *Dorsal sepal* ovate-lanceolate, acuminate to subcaudate, 1.4–1.6 × 0.3–0.4cm; *lateral sepals* lanceolate, falcate, acute to acuminate, 0.9–1.4 × 0.25–0.3cm. *Petals* linear-lanceolate, acute, 0.9–1.1 × 0.2–0.3cm. Lip adnate to the column, simple, shortly clawed, trowel-shaped, margins entire at base and apex, irregularly crenate-dentate at sides, apex acuminate, c.9 × 5mm; disc with 2 converging lamellae extending from base to mid-way; spur stout, cylindric, 1.5–2mm long. *Column* thick, c.4mm long. Fruit ellipsoid, c.2 × 1cm.

Bhutan: S – Sankosh district (near Dagapela); **Darjeeling** (Mahaldiram, Ramman); **Sikkim** (Lachung). 2000–2400m. Fl. May–August; Fr. August.

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. From the Latin *trulliformis* (shaped like a bricklayer's trowel) in reference to the lip shape.

NOTE. This is the first report of *C. trulliformis* from Bhutan.

18. C. whiteana King & Pantling in J. Asiat. Soc. Bengal 65(2): 121 (1896). Type: India, Choongthang (Chunthang), *Pantling* 365 (holo. CAL, iso. BM! K!).

Calanthe wardii W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 13: 194 (1921). Type: Myanmar (Burma), Naung-Chaung, *Kingdon-Ward* 1734 (holo. E).

Plant 100–130cm tall. *Pseudobulbs* conical, smooth, partially enveloped by sheaths, 3–4cm long; internodes 4 or 5; sheaths 4 or 5, broadly triangular, acuminate, many-veined, 7–16 × 6–7cm. *Leaves* 4–6, linear-lanceolate, acute, narrowed towards sessile base, 60–100 × 6.3–8.2cm. *Inflorescence* lateral, erect; peduncle puberulous, terete, stout, sheathed, 60–75cm long; sheaths distant, 10–12.5cm long; rachis 36–54cm long; floral bracts linear-lanceolate, acuminate, deflexed, 7-veined, 1–5.5 × 0.4–0.75cm. *Flowers* 1.6–2.5cm long, uniformly yellow to yellowish green; pedicel and ovary 1–1.5cm long. *Sepals* subsimilar, reflexed, fleshy; *dorsal sepal* elliptic-oblong, subacute, 3-veined, 7–9 × 4–5mm; *lateral sepals* elliptic, subovate, subacute, 5-veined, 0.7–1.1 × 0.55–0.6cm. *Petals* elliptic-lanceolate, acute, 1–1.2 × 0.3–0.32cm. Lip simple, adnate to column, spurred, c.5 × 9mm (at base when spread); transversely elliptic-quadrate, 2-lobulate at apex, lobules reflexed, margins entire; disc with 3–5 papillose ridges from base to apex; *spur* subclavate, curved, puberulent, 2–2.4cm long. *Column* stout, c.3–4mm long.

Bhutan: C – Tongsa district (Berthi (M.F.B.)); **Sikkim** (Chunthang). 1675–1980m. Fl. May–June.

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. Named after J. Claude White (1853–1918), Political Agent in Sikkim who visited Bhutan and helped King and Pantling in their collecting in the Himalayas.

NOTE. Lucksom (1994b) reported the rediscovery of this rare species, which had not been seen for over a hundred years, and considered it to be one of the most beautiful of all Calanthes.

19. C. yuksomnensis S.Z. Lucksom in J. Bombay Nat. Hist. Soc. 95(2): 319 (1998). Type: India, Sikkim, Yuksom, *S.Z. Lucksom* 311 (holo. CAL!, iso. Gangtok, Forest Dept. Herb.).

Plant 20–30cm tall. *Pseudobulbs* ovoid, 2–3 × 1.5–2cm; internodes 2 or 3. *Leaves* 3, elliptic-lanceolate, acute, petiolate, 20–30 × 6–12.1cm, new leaves sheathing at base; petiole channelled, 20–30cm long. *Inflorescence* 2- to 10-flowered; peduncle erect, terete, puberulous, sheathed, 15–26cm long; sheath 1, lanceolate, 1cm long; rachis terete, puberulous, 5–7cm long; floral bracts lanceolate. *Flowers* mildly fragrant, 3.3–4.2cm across; sepals and petals brownish-purple with green tips and bases, lip creamy-white. *Dorsal sepal* elliptic, acute, puberulous externally, 5- to 7-veined, 1.85–1.95 × 0.76–0.82cm; *lateral sepals* similar, spreading, 5-veined. *Petals* rhombic, subacuminate, 3-veined, 1.7–1.75 × 0.4–0.5cm. Lip 3-lobed, spurred, base clawed and adnate to column, 2.35–2.4 × 1.8–1.9cm; lateral lobes ovate-oblong, obtuse; mid-lobe subreniform, 2-lobulate, lobules subobovate, obtuse, crenulate; disc with 3 shallow elongate calluses; spur straight, cylindric, 2.3cm long. *Column* c.7.5mm long; anther ovate; pollinia 8, obovate to clavate, subequal, 3–3.2mm long.

Sikkim (Yoksam). On forest floor; 1400–1800m. Fl. May–June.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From Yuksom in Sikkim where the type material was collected.
NOTE. *C. yuksomnensis* is closely related to *C. herbacea* but it differs in floral colour (the sepals and petals are brownish-purple) and its larger flowers.

Section **Styloglossum** Breda, Gen. Sp. Orch. Asclep.: t.7 (1828).

20. **C. clavata** Lindl., Gen. Sp. Orchid. Pl.: 251 (1833). Type: Bangladesh, Sylhet, coll. F. *De Silva* Wall. Cat. 7343 (holo. K-W!).
Alismorchis clavata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).
Calanthe clavata var. *malipoensis* Z.H. Tsi in Acta Phytotax. Sin. 19(3): 508 (1981). Type: China, Yunnan, Malipo, *C.W. Wang* 86442 (holo. PE).

Plant 40–80cm tall; *rhizome* curved, 4–5 × c.0.5cm. *Leaves* 2 or 3, oblong-elliptic, acute to acuminate, strongly veined below, petiolate, 22–55 × 4.5–8cm; petiole grooved, 20–25cm long. *Inflorescence* arising from apex of rhizome, subsecund, laxly to subdensely many-flowered; peduncle sheathed, 21–26cm long; sheaths 3 or 4, inflated, tubular, ovate-lanceolate, acute, 2.5–5cm long; rachis 10–14cm long; floral bracts caducous, lanceolate, acute, c.7 × 1.5mm. *Flowers* 1–2cm across, uniformly yellow; pedicel and ovary inflated in apical half, c.1.5cm long. *Sepals* similar, elliptic-lanceolate, acute to acuminate, 0.8–1 × 0.25–0.3cm. *Petals* lanceolate, acute to acuminate, 0.8–1 × 0.25–0.3cm. *Lip* adnate to column, 3-lobed, 6–8 × 4–5mm; lateral lobes short, elliptic to subtriangular, obtuse with 2 raised, keeled lamellae between; mid-lobe ovate, margins entire to weakly undulate, apex retuse to emarginate, mucronate; *spur* cylindric, clavate, 7–9mm long. *Column* straight, thick at base, c.5mm long. *Fruit* ellipsoid, 1–1.3 × 0.5–0.6cm.

Darjeeling (Lebong Cantonment); **Sikkim** (Chunthang, Naru? Valley). 1330–1660m. Fl. October.

GENERAL DISTRIBUTION. NE India, Bangladesh, Myanmar to Vietnam.
ETYMOLOGY. From the Latin *clavatus* (club-shaped) in reference to the shape of the spur.
NOTES. King & Pantling (1898) treated *C. clavata* as conspecific with *C. densiflora*, while Hooker (1890) and Seidenfaden (1975a) treated them as distinct species. We have examined the type material (at K-W) which, however, is of poor quality. *C. clavata* has a longer inflorescence, a longer, less dense raceme and a clavate spur whereas *C. densiflora* has an inflated, subclavate spur. We retain them as separate species here, but feel that further field work is needed to resolve the difficulty.

21. **C. densiflora** Lindl., Gen. Sp. Orchid. Pl.: 250 (1833). Type: ?India, Mt. Sylhet, coll. F. *De Silva* Wall. Cat. 7344 (holo. K-LINDL!, iso. K-W!).
Alismorchis densiflora (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).
Calanthe kazuoi Yamamoto in Trans. Nat. Hist. Soc. Taiwan (Formosa) 20: 38 (1930). Type from Taiwan.

Plant 40–60cm tall; *rhizome* wavy, fusiform, fibrous, 2.5–6 × 0.5–1cm; roots widely spaced along rhizome. *Leaves* 2 or 3, narrowly elliptic to oblong-elliptic, acute to acuminate, petiolate, margins entire, prominently 5-veined below, 18–40 × 2–6cm; petiole grooved, 14–22cm long. *Inflorescence* arising from apex of rhizome, short, globose-corymbose to cylindric, densely many-flowered; peduncle sheathed, 9–18cm long; sheaths 2 or 3, tubular, inflated, ovate, acute, 2–3.5 × 0.5–1cm; rachis 1–3cm long;

floral bracts caducous, elliptic-lanceolate, acute, 1–2 × 0.1–0.5cm. *Flowers* c.1.5cm long, uniformly yellow; pedicel and ovary slender, 1.4–1.8cm long. *Sepals* similar, lanceolate, acute, 1.4–1.6 × 0.25–0.4cm. *Petals* oblanceolate to subspathulate, acute, 1.1–1.3 × 0.3–0.45cm. *Lip* adnate to column, 3-lobed, 7–8 × 3–4mm; lateral lobes large, ovate to subtriangular, erect, with 2 large, rounded, keeled lamellae between them; mid-lobe broadly round to subquadrate, emarginate, sinus broad, shallow; *spur* cylindric, subclavate, 0.9–1cm long. *Column* straight, c.5–6mm long. *Fruit* ovoid-ellipsoid, long-stalked, clustered, 1–1.1 × 0.5–0.6cm; stalk c.1.4cm long.

Darjeeling (Dalkajhar); **Sikkim** (Khechoiperi Lake). 160–1830m. Fl. October.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Taiwan and Vietnam.
ETYMOLOGY. From the Latin *densi-* (crowded) and *-florus* (flowered).

Doubtfully recorded and imperfectly known species.

C. **pachystalix** Rchb. f. ex Hook. f., Fl. Brit. India 5(2): 850 (1890). Type: India, W Himalaya, *Falconer* 1054 (holo. K-LINDL!).

NOTE. We have a field record of this species from Bhutan (D.B. Gurung, pers. comm.) but have seen no material ourselves and so cannot confirm it.

C. **uncata** Lindl., Fol. Orchid. Calanthe 6,7: 6, no.19 (1855). Type: India, Darjeeling, *Griffith* s.n. (holo. K-LINDL!).
Alismorchis uncata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).

NOTES. *C. uncata* was described by Lindley based on a single Griffith collection from Darjeeling. He described the spur as 'uncinato' and commented that it was 'remarkably hooked upwards'. This appears to be the main distinguishing feature of the species but unfortunately the type material is too poor to be able to draw valid conclusions from. The type sheet has one flower with a coiled spur, and others with curved spurs. We have observed this feature in other herbarium specimens and consider that it is likely to be an artifact. Hooker (1890) commented that he could find no callus on the lip and thought it very near to *C. griffithii*. A second Griffith collection (5280) at Kew may represent this species but the quality is also poor, its lip is ecallose and the spur uncinate. There have been no other collections and we suspect that this plant represents a peloric form of *C. griffithii* but depend upon further collections to clarify the position.

Jain & Mehrotra (1984) commented that this species was 'perhaps extinct'.

65. **Cephalantheropsis** Guillaumin

Plants terrestrial; *rhizome* slender, creeping. *Stem* erect, bamboo-like, leafy above. *Leaves* arising from stem apex, jointed with sheaths, plicate. *Inflorescence* axillary, erect, racemose, laxly few- to many-flowered. *Sepals* and *petals* subsimilar, free, spreading. Lip free, ± gibbous at base, spurless, 3-lobed; lateral lobes enveloping column. *Column* short, truncate, lacking a foot; pollinia 8, in 4 equal pairs.

The genus *Cephalantheropsis* was established in 1960 by André Guillaumin (1885–1974) in the journal *Bulletin du Muséum National d'Histoire Naturelle, Paris*. The genus comprises about six species widespread in E and SE Asia from Japan, China, Taiwan, India to Thaliand, Malaysia and Indonesia.

Garay & Sweet (1974) considered *Cephalantheropsis* to represent a connecting link between *Calanthe* and *Phaius*. It differs from *Phaius* in that it is spurless, has a weakly gibbous, rather than saccate, lip base and a distinctive lip and from *Calanthe* in that the column is not fused to the lip base. Ormerod (1998) reviewed the genus.

TYPE. *Cephalantheropsis lateriscapa* Guillaumin.
ETYMOLOGY. From *Cephalanthera* (an orchid genus) and the Greek *opsis* (looking like).

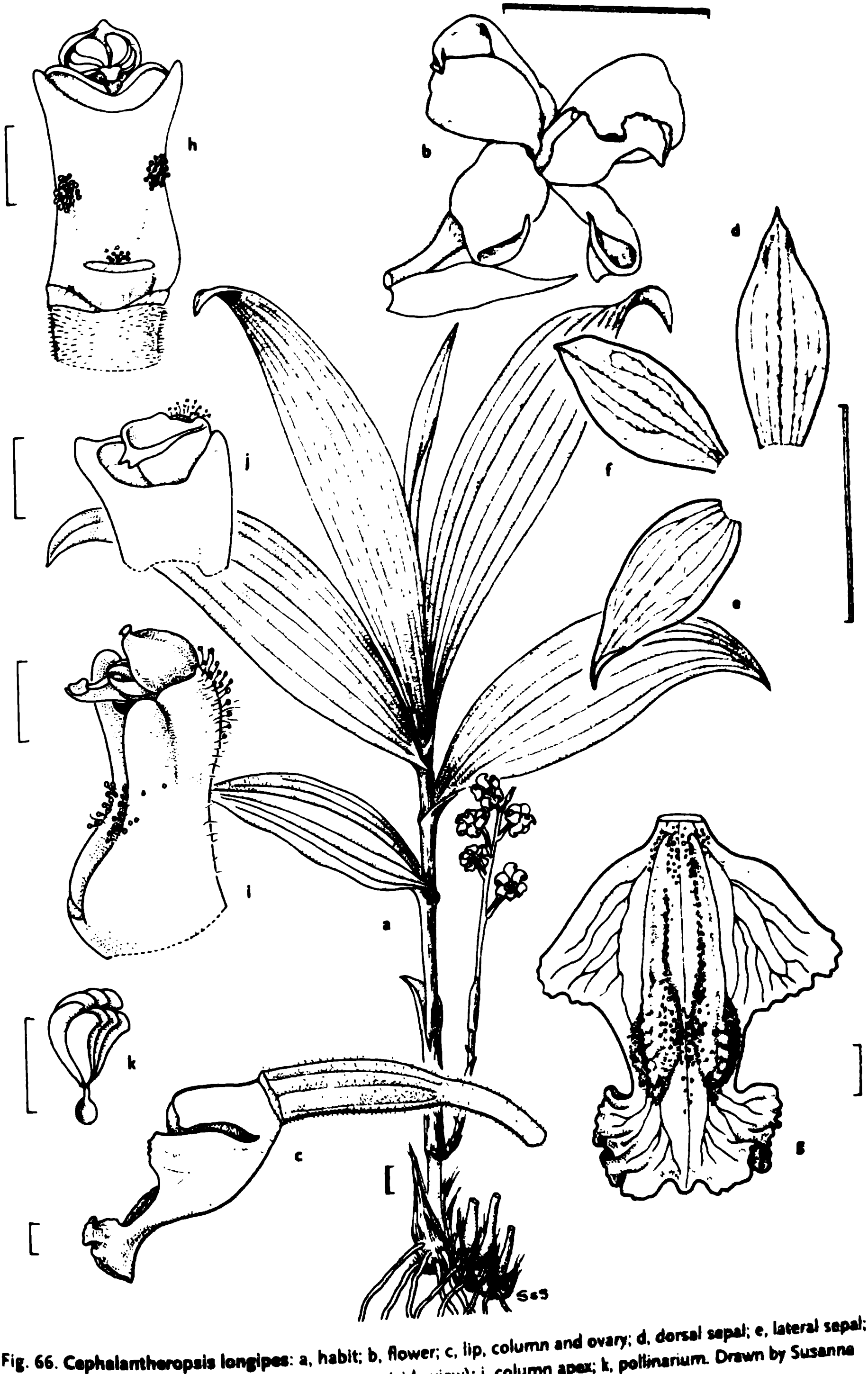


Fig. 66. **Cephalantheropsis longipes**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (front view); i, column (side view); j, column apex; k, pollinarium. Drawn by Susanne Stuart-Smith, a from *Pantling* 2 (K); b–k from *Shose*, cult. Kew 20265 (K).

1. **C. longipes** (Hook. f.) Ormerod in Orchid Digest 62(4): 156 (1998). Type: India, Sikkim, King s.n. (holo. BM!).
Calanthe longipes Hook. f., Fl. Brit. India 6(1): 195 (1890).
Alismorchis longipes (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 650 (1891).
Phaius longipes (Hook. f.) Holttum in Gard. Bull. Straits Settlem. 11: 286 (1947).
P. mindorensis Ames in Philipp. J. Sci., C 2: 324 (1907). Type from the Philippines.
Calanthe dolichopoda Fukuyama in Bot. Mag. (Tokyo) 49: 296 (1933). Type from Taiwan.

Plant 30–50cm tall. *Stem* slightly swollen at base, bearing bladeless sheaths, 3–7mm thick; sheaths membranous, tubular, ovate-lanceolate, acute, 4.5–8.5cm long. *Leaves* 5–8, elliptic to elliptic-oblong, acuminate-caudate, subsessile to petiolate, sheathing at base, 5.5–23 × 0.9–4.8cm; petiole short, 0.5–3cm long. *Inflorescence* arising about half-way up stem, laxly 5- to 15-flowered; peduncle sheathed, puberulent, 5–13cm long; sheaths tubular, lanceolate, acute, 1.5–2.5 × 0.4–0.5cm; rachis puberulent, 3–9cm long; floral bracts caducous, lanceolate, acuminate (not seen). *Flowers* c.1cm across; sepals and petals pure white, lip white with a yellow band along centre; pedicel and ovary clavate, pubescent, 0.9–1.5cm long. *Sepals* similar, lanceolate, acuminate, spreading, pubescent externally, 8–9 × 3–3.5mm. *Petals* obovate, acute, margins erose, 6–7 × 2.5–3mm. *Lip* adnate to column base, spurless, 3-lobed, 5–6mm long; lateral lobes erect, triangular to rounded, margins crenulate; mid-lobe oblong-flabelliform, emarginate, margins undulate-crenulate; disc 2-keeled, from base to apex. *Column* hirsute at apex, c.3mm long. *Fruit* ellipsoid, 1.1–1.3 × 0.5–0.6cm. **Fig. 66.**

Sikkim (unlocalised King and Pantling specimens). 2000m. Fl. October.

GENERAL DISTRIBUTION. NE India, Myanmar, China (Yunnan), Taiwan and the Philippines.
ETYMOLOGY. From the Latin *longus* (long) and *pes* (foot) in reference to the long stem.
NOTE. *C. gracilis* (Lindl.) S.Y. Hu has been commonly reported from the Himalayas, but when Ormerod (1988) monographed the genus he reduced this species to the synonymy of *C. obcordata* (Lindl.) Ormerod, and referred all Himalayan material to *C. longipes*.

66. **Eriodes** Rolfe

Plants epiphytic or lithophytic. *Pseudobulbs* conical to globose. *Leaves* arising from apex of pseudobulb, herbaceous, veined, elliptic-lanceolate, acute to acuminate. *Inflorescence* basal, racemose; floral bracts lanceolate, persistent. *Flowers* medium in size, strongly veined; pedicel and ovary with brown ramentae. *Sepals* reflexed, lanceolate; lateral sepals connate at base. *Petals* linear, reflexed. *Lip* simple, narrow, mobile, recurved. *Column* strongly angled, foot present; pollinia 8, in 2 groups of 4.

The genus *Eriodes* was established in 1915 by Robert Allen Rolfe (1855–1921) in the *Orchid Review*. Griffith found a plant in the Khasia Hills that he called *Erioidea* sp. which was later described by Lindley as *Tainia barbata* in 1857. In 1915 Schlechter transferred this species to a new genus *Tainiopsis* having overlooked the earlier use of this name by Hayata in 1914. The genus is monotypic and is distributed from NE India, Bhutan, Myanmar to Vietnam.

TYPE. *Eriodes barbata* (Lindl.) Rolfe; basionym: *Tainia barbata* Lindl.
ETYMOLOGY. From a resemblance to the related orchid genus *Eria*.

1. **E. barbata** (Lindl.) Rolfe in Orchid Rev. 23: 326 (1915). Type: India, Khasia, Griffith 5297 (holo. K!).
Erioidea sp. Griff., Itin. Pl. Khasyah Mts.: 83 (1848).
Eriae sp. Griff., Not. Pl. Asiat. 3: 304 (1851).
Tainia barbata Lindl. in Gard. Chron. 1857: 68 (1857).
Eria barbata (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 270 (1861).
Pinalia barbata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).
Tainiopsis barbata (Lindl.) Schltr. in Orchis 9: 9 (1915).

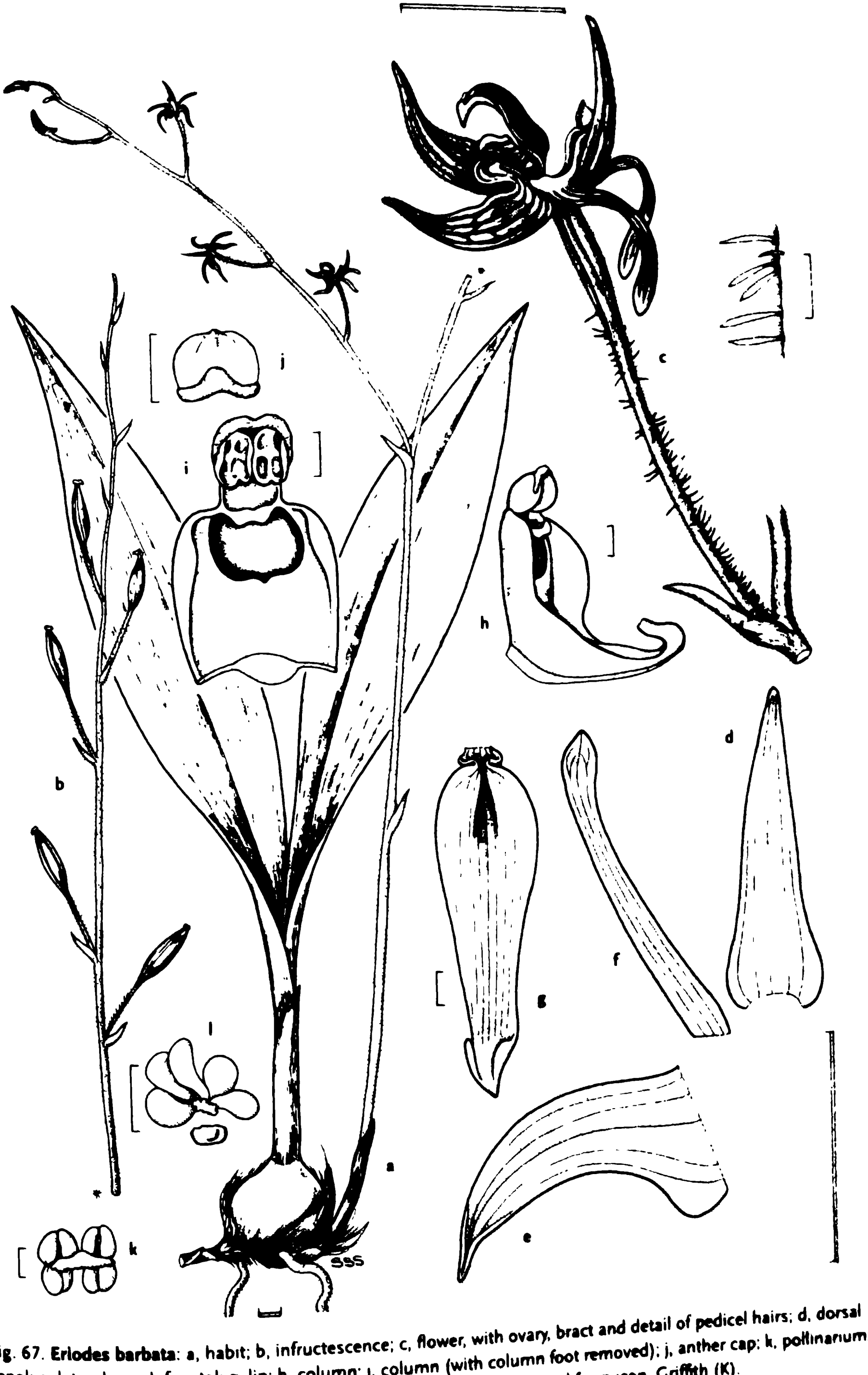


Fig. 67. **Eriodes barbata**: a, habit; b, infructescence; c, flower, with ovary, bract and detail of pedicel hairs; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column; i, column (with column foot removed); j, anther cap; k, pollinarium; l, half pollinarium. Drawn by Susanna Stuart-Smith, a–k *Griffith* 5297 (K); l from icon. Griffith (K).

Coelogyne nigrofurfuracea Guillaumin in Bull. Mus. Natl. Hist. Nat. sér.2, 27(2): 143 (1955). Type from Vietnam.

Neotainiopsis barbata (Lindl.) Raizada & Bennet in Indian Forester 107: 433 (1981).

Plant 50–70cm tall. *Pseudobulbs* wrinkled when dry, fibrous-sheathed at base, 2–5 × 1.6–3.5cm. *Leaves* 1–3, elliptic-lanceolate, acute to acuminate, with 3–5 main veins, petiolate, 14–35 × 2.5–5.3cm; petiole 5–8cm long. *Inflorescence* laxly c.9-flowered; peduncle narrowed from broad base, sheathed, pubescent, 30–40cm long; sheaths lanceolate, acute, pubescent, 3–3.5 × 0.6–0.8cm; rachis slender, weakly zigzag, pubescent, 25–40cm long; floral bracts lanceolate, acute, pubescent, 0.9–1.5 × 0.3–0.4cm. *Flowers* fragrant, 2–2.5cm across, yellow with red stripes; pedicel and ovary 2.5–4.5cm long, pubescent and with flat, brown, hair-like ramentae. *Sepals* subsimilar, elliptic-lanceolate, acute, 5-veined, reflexed, spreading, pubescent externally, 1–1.5 × 0.2–0.45cm; *lateral sepals* falcate, connate at base to form a mentum; *mentum* 2–3mm long. *Petals* linear-oblong, obtuse, 3-veined, glabrous, 1.2–1.3 × 0.5–1cm. *Lip* simple, attached to column foot, strongly recurved, broadly ovate, strongly veined, apex sagittate with 2 small side projections, 6–9 × 3–5mm. *Column* curved, sharply angled, broadly winged, 3–5mm long; column foot long. *Fruit* ellipsoid, 1.8–2.4 × 0.5–0.7cm. **Fig. 67.**

Bhutan: C – Punakha district (Samadingkha?). On *Gordonia* sp.; 1260m. Fl. October–January.

GENERAL DISTRIBUTION. NE India, Myanmar, China (Yunnan), Thailand and Vietnam.
ETYMOLOGY. From the Latin *barbatus* (bearded, long-haired) in reference to the characteristic hair-like ramentae on the pedicel.

67. Pachystoma Bl.

Plants terrestrial; *rhizome* subterranean, fleshy, swelling into a horizontal, fusiform tuber. *Leaves* withering before inflorescence appears. *Inflorescence* racemose, long, many-flowered. *Flowers* resupinate, not widely opening, often pendent, pubescent. *Lateral sepals* swollen at base, resembling a small mentum. *Lip* 3-lobed, immobile, slightly saccate at base; disc with 5 tuberculate longitudinal keels. *Column* slender, puberulent; pollinia 8.

The genus *Pachystoma* was established in 1825 by Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus is probably monotypic and widely distributed from India, north to China, through the Malay Archipelago to New Guinea, Australia and New Caledonia. Seidenfaden (1986) discussed the taxonomy and provided a more complete synonymy.

TYPE. *Pachystoma pubescens* Bl.
ETYMOLOGY. From the Greek *pachy-* (thick) and *stoma* (mouth) in reference to the thickened lip keels and the mouth-like appearance of the swollen bases of the lateral sepals.

1. P. pubescens Bl., Bijdr.: 376, t.29 (1825). Type: Java, Tijradjas, Krawang, Blume s.n. (holo. L! Herb. no. 903162353).

Apaturia senilis Lindl., Gen. Sp. Orchid. Pl.: 130 (1831). Types: India, Kaligunj, coll. *Buchanan-Hamilton* Wall. Cat. 3739A (syn. K-LINDL!, isosyn. K-W!); ?India, Mt. Sylhet, coll. H. *Bruce* Wall. Cat. 3739B (syn. K-LINDL!, isosyn. K-W!).

Pachystoma senile (Lindl.) Rchb. f. in Bonplandia 3: 250 (1858).

Pachystoma edgeworthii Falconer ex Rchb. f. in Walpers, Ann. Bot. Syst. 6: 463 (1862). Type: without provenance, icon. Falconer (holo. K!).

Plant 30–60cm tall; *rhizome* tuberous, subcylindric. *Leaves* 1 or 2, linear-lanceolate, tapering towards both ends, plicate, petiolate, 30–45 (including petiole) × 0.7–1cm. *Inflorescence* subdensely 12- to 20-flowered; peduncle sheathed, 30–55cm long; sheaths 7–10, lanceolate-ovate, acuminate to filiform, 2.5–4cm long; rachis 4–14cm long; floral bracts linear-lanceolate, acuminate, 1.5–2.5 × 0.2–0.3cm.

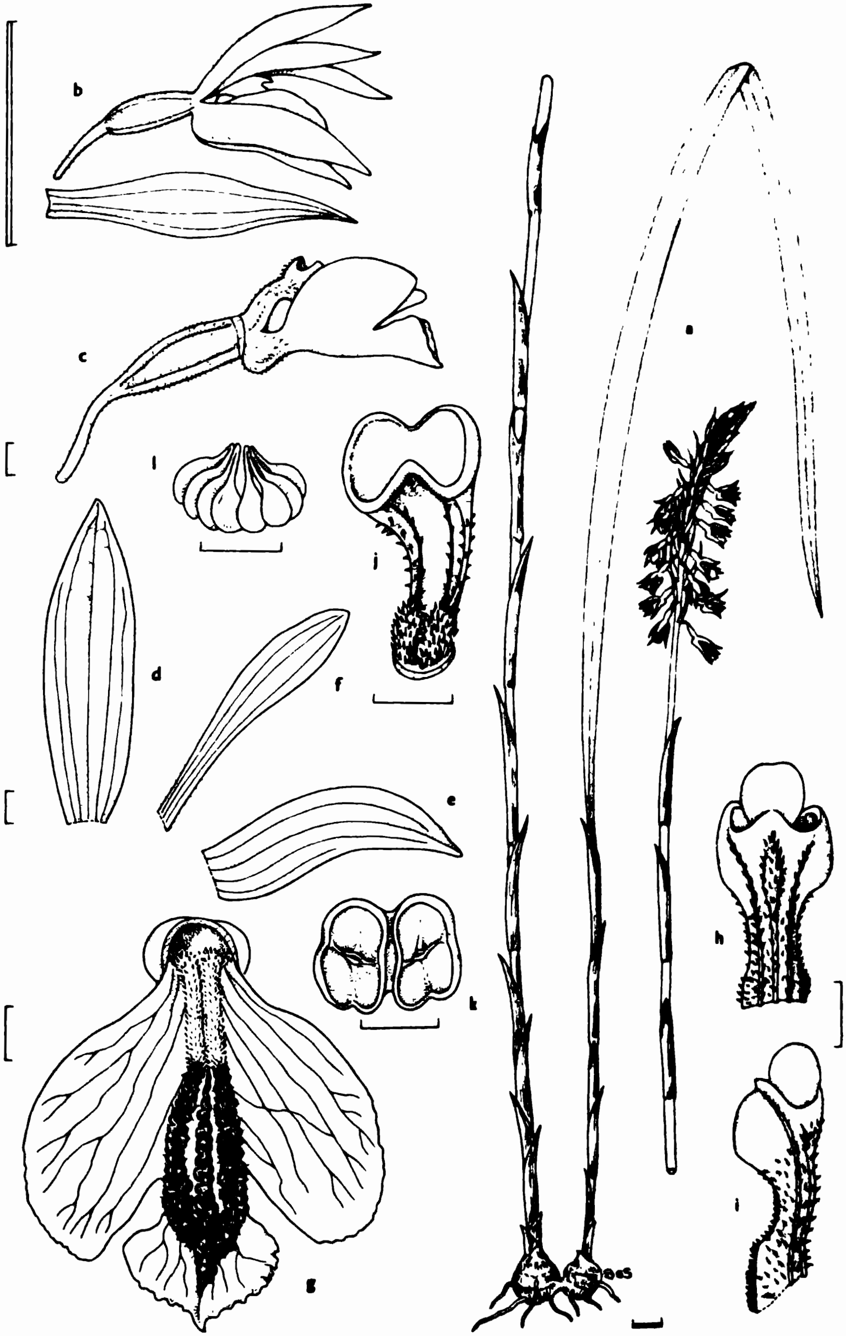


Fig. 68. **Pachystoma pubescens**: a, habit (with detached inflorescence); b, flower with bract; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (back view); i, column (side view); j, column (anther removed); k, anther; l, pollinia. Drawn by Susanna Stuart-Smith, a from *Clarke* 27017 (K); b–l from '*East India Company*' 1028 (K).

Flowers 1–1.2cm long, not widely opening, pinkish with apex of sepals and petals yellow to dull pink-purple, disc on lip greenish-yellow; pedicel and ovary slender, curved, pubescent, 5–8mm long. *Dorsal sepal* lanceolate-ovate, acute to obtuse, boat-shaped, pubescent externally, 1–1.2 × 0.25–0.4cm; *lateral sepals* similar, weakly falcate, acuminate, pubescent externally, 1–1.1 × 0.25–0.4cm. *Petals* linear, obtuse, 1–1 1 × 0.1–0.2cm. *Lip* 3-lobed, 1–1.1 × 0.5–0.6cm; lateral lobes erect, obliquely oblong to obliquely ovate, obtuse; mid-lobe oblong, slightly dilated at apex, c.3.5 × 2mm; disc with 3–5 wavy, papillose keels. *Column* curved, slender, 2-winged at apex, 7–8cm long. **Fig. 68.**

Bhutan: C – Punakha (near Bhotokha (F.E.H.2), between Punakha and Tinlegang) and Tongsa (Kyi La, Shamgong Dzong) districts; **Terai** (Jalpaiguri, ?Phulbari, Siliguri); **Duars** (unlocalised *Haines* and *Pantling* specimens). On grassy hillside, in *Pinus roxburghii* forest, in savannah (near *Ficus virens*); 500–1800m. Fl. (November–)February–May.

GENERAL DISTRIBUTION. India, ?Nepal, Bangladesh, Myanmar, China, SE Asia to the Philippines, Malaysia, Sumatra, Java, Borneo, Sulawesi and New Guinea.

ETYMOLOGY. From the Latin *pubescens* (hairy) in reference to the lip disc.

NOTES. Seidenfaden (1986) considered that there might only be a single variable species in the genus. Plants previously known as *P. senile* are now treated in the synonymy of *P. pubescens*.

68. Phaius Loureiro

Plants terrestrial. *Stems* clustered, cylindric or pseudobulbous. *Pseudobulbs* (when present) conical or ovoid. *Leaves* plicate, medium-sized to large, petiolate, narrowly obovate or narrowly elliptic, acuminate. *Inflorescence* lateral from base of pseudobulb, or axillary, laxly or densely racemose. *Flowers* usually large, resupinate, turning blue-black when old or damaged. *Sepals* and *petals* similar, free, rather fleshy, spreading or reflexed. *Lip* free, entire to obscurely 3-lobed, erect, sessile, partly adnate to and embracing the column to form a tube, gibbous or shortly spurred. *Column* long or short, fleshy, curved, with an inflexd foot; pollinia 8.

The genus *Phaius* was established in 1790 by João de Loureiro (1717–1791) in his *Flora Cochinchinensis*. Lindley (1831) used the orthographic variant *Phajus*. The genus comprises about 30 species distributed in the Old World tropics of Africa, Madagascar, S and SE Asia, Australia, New Guinea and the Pacific Islands. Seidenfaden (1986) revised the Thai species and provided a more complete synonymy.

Pollination of *P. tankervilleae* by carpenter bees (*Xylocopa* sp.) that visit the external nectaries, and autogamy with pollination in the bud, have both been reported by van der Pijl & Dodson (1966).

TYPE. *Phaius grandiflorus* Loureiro.

ETYMOLOGY. From the Greek *phaios* (grey, swarthy) referring to the predominant brownish-blue hue of the flowers, especially when old or damaged.

Key to species

1. Inflorescence arising from leaf axil halfway up stem .... **2. P. mishmensis**
+ Inflorescence arising from base of stem or side of pseudobulb 2

2. Peduncle 2.5–16cm long .... **3. P. nanus**
+ Peduncle more than 30cm long 3

3. Sepals and petals erect-spreading, yellow; mid-lobe of lip not protruding; petals and lip yellow to greenish-white, lip with red-brown margins .... **1. P. flavus**
+ Sepals and petals spreading, purple within, white without; mid-lobe of lip protruding; petals and lip buff and purple .... **4. P. tankervilleae**

1. **P. flavus** (Bl.) Lindl., Gen. Sp. Orchid. Pl.: 128 (1831). Type: Java, Mount Gede, Blume's collector s.n. (holo. L! Herb. no. 903162381).

Limodorum flavum Bl., Bijdr. 8: 375 (1825).

Phaius maculatus Lindl., Gen. Sp. Orchid. Pl.: 127 (1831). Type: Nepal, Sanko, coll. Wallich Wall. Cat. 3748 (holo. K-LINDL!, iso. K-W!).

Plant 40–100cm tall. *Pseudobulbs* ovoid-ellipsoid to cylindric, 7–10 × 1.5–3cm. *Leaves* 4–6, ovate-elliptic to elliptic-lanceolate, acute, margins weakly undulate, green with yellow or white spotting, 30–60 × 5–20cm; petiole grooved, 3–9cm long. *Inflorescence* lateral, densely many-flowered; peduncle sheathed, angled, glabrous, 15–35cm long; sheaths elliptic-lanceolate, acute, 3–5cm long; rachis glabrous, 5–20cm long; floral bracts ovate, acute, 2.5–4cm long. *Flowers* showy, 4–7cm across; sepals and petals yellow, lip yellow with orange or brown markings; pedicel and ovary 2–3cm long. *Sepals* subsimilar, spreading, concave, 2.5–4 × 0.8–1.5cm; *dorsal sepal* oblong-elliptic, subspathulate, obtuse to subacute; *lateral sepals* elliptic, obtuse, oblique to weakly falcate. *Petals* oblong-elliptic, spathulate, obtuse to subacute, 2.5–4 × 0.8–1.5cm. *Lip* 3-lobed, spurred, erect, 2.5–4.5 × 2.5–4.5cm; lateral lobes erect, enfolding the column, oblong, obtuse; mid-lobe ovate to suborbicular, slightly deflexed in front, margins crisped-undulate; disc with 3 prominent keels; *spur* conical, 5–8mm long. *Column* erect, curved, pubescent, 1.5–2cm long. **Fig. 69a–l.**

Bhutan: S – Gaylegphug district (Nabzi); **C** – Tongsa district (7km SW of Tingtinbi); **N** – Upper Mo Chu district (below Tamji); **Terai** (unlocalised Brandis specimen); **Darjeeling** (Badamtam, below Lebong, Peshok Tea Garden, Rangit Valley); **Sikkim** (Gangtok). On moss covered logs, in scrub; 660–3353m. Fl. (November–)January–May.

GENERAL DISTRIBUTION. N India, Nepal, Myanmar, China, Japan, the Philippines, Thailand, Laos, Vietnam, Malaysia, New Guinea and the south-west Pacific Islands.

ETYMOLOGY. From the Latin *flavus* (pale yellow) in reference to the flower colour.

NOTE. An extended synonymy can be found in Seidenfaden (1986).

2. **P. mishmensis** (Lindl. & Paxton) Rchb. f. in Bonplandia 5: 43 (1857). Type: India, Mishmee Hills, Griffith s.n. (holo. K-LINDL!).

Limatodes mishmensis Lindl. & Paxton in Paxton's Fl. Gard. 3: 36 (1852).

Plant 40–140cm tall. *Pseudobulbs* stem-like, narrowly fusiform-cylindric, fleshy, 2–6.5 × 0.4–1.9cm. *Leaves* 6–8, elliptic-lanceolate to oblong-ovate, acuminate to acute, 15–30 × 6–12.5cm; petiole sheathing at base, 15–23cm long. *Inflorescence* 1 or 2, axillary, laxly few-flowered; peduncle weakly zigzag, sheathed, 20–27cm long; sheaths elliptic-lanceolate, subacute, 2–3cm long; rachis zigzag, 9–15cm long; floral bracts lanceolate, caducous (not seen). *Flowers* erect, 5–6cm across; sepals and petals pale pink, dark red or purple-brown, lip white to pink, speckled with purple, spur usually yellowish; pedicel and ovary 1.5–3cm long. *Sepals* similar, erect to spreading, linear-oblong, subacute, concave, 2.5–3.5 × 0.5–1cm. *Petals* linear-oblanceolate, acute, 2–3 × 0.4–0.6cm. *Lip* 3-lobed, jointed at base of column, spurred, base cuneate, 2.5–3 × 1.5–2.5cm; lateral lobes erect, rounded, enfolding the column; mid-lobe entire, reflexed, subquadrate to oblong, emarginate to retuse at apex; disc with a central thickened, hirsute-pubescent ridge from base to apex; *spur* narrowly cylindric, acute, curved, 1–1.5cm long. *Column* straight, 1.2–1.6cm long; anther cap pubescent. **Fig. 69m–n.**

Bhutan: C – Punakha district (Rimchu); **N** – Upper Mo Chu district (Tamji); **Darjeeling** (Rishep, near Tista River); **Sikkim** (Rimbi Chhu). In deep shade; 1000–3353m. Fl. October–January.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand, Laos, Vietnam, Okinawa and the Philippines.

ETYMOLOGY. From the Mishmi Hills in NE India where the type specimen was collected.

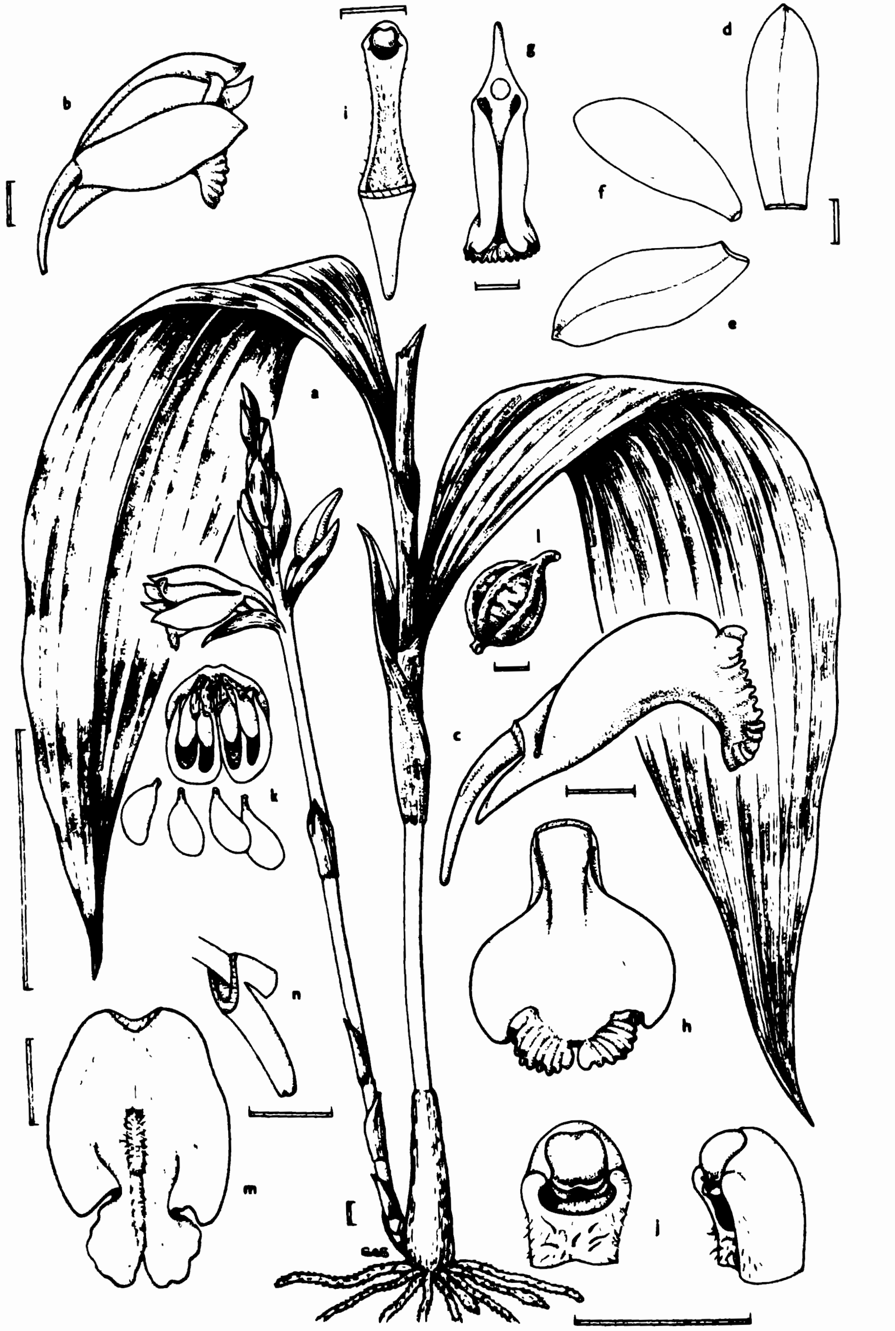


Fig. 69 **Phaius flavus**: a, habit; b, flower; c, lip, ovary and column; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip (spread); i, column; j, column apex (two views); k, anther and pollinia; l, fruit. **P. mishmensis**: m, lip; n, lip base (detail). Drawn by Susanna Stuart-Smith, a, from *Hooker* s.n. (K); b–k from *Bowden-Smith* 20316 (K); l, from t.149 in King & Pantling (1898); m–n from cult. Kew 21210 (K).

3. P. nanus Hook. f., Fl. Brit. India 6(1): 192 (1890); Icon. Pl. 22: t.2088 (1893). Type: India, W Bengal Duars, Buxa Reserve, *Gamble* 6672.B (holo. K!).

Plant 16–20cm tall; *rhizome* short, lacking pseudobulbs; *roots* clustered. *Leaves* 1–4, narrowly elliptic to oblong-lanceolate, acuminate, the lower sheath-like, 10–24 × 3–4cm; petiole grooved, 4–9cm long. *Inflorescence* 2- or 3-flowered; peduncle erect, glabrous, sheathed, 8–16cm long; sheaths elliptic-lanceolate, acute, 2–4 × 0.6–0.8cm; rachis 2.5–3cm long; floral bracts lanceolate, boat-shaped, acute, 1.5–2 × 0.4–0.7cm. *Flowers* 5–6cm long, colour not known; pedicel and ovary c.1.5cm long. *Sepals* similar, narrowly oblong, acuminate, spreading, 3–4.5 × 0.6–1cm. *Petals* narrowly oblong, acuminate, spreading, 2.5–4 × 0.6–0.9cm. *Lip* obscurely 3-lobed, spurred, 1.5–4 × 1.5–3cm; lateral lobes small, rounded; mid-lobe suborbicular, plicate, emarginate, many-veined, puberulous-filiform, margins undulate; *spur* conical, c.2mm long. *Column* erect, puberulous, c.1.5cm long.

Duars (Buxa Reserved Forest, E of Jaldacca River); **Darjeeling** (Naksalbari). In savannah tracts. Fl. February.

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. From the Greek *nanos* (dwarf) in reference to the relatively small size of this species.

4. P. tankervilleae (Banks ex l'Héritier) Bl., Mus. Bot. 2: 177 (1856). Type: China, introduced by Fothergill, based on icon. J. Sowerby '1787' (holo. BM!).

Limodorum tankervilleae Banks ex l'Héritier, Sert. Angl.: 28 (1789).

Phaius veratrifolius Wall. ex Lindl., loc. cit. (1831), **syn. nov.** Type: Bangladesh, Sylhet, coll. *F. De Silva* Wall. Cat. 3746 (holo. K-LINDL!, iso. K-W!).

P. wallichii Lindl. in Wall., Pl. Asiat. Rar. 2: 46, t.158 (1831). Type: Bangladesh, Sylhet, *M.R. Smith* s.n. (holo. CAL).

P. blumei var. *assamica* Rchb. f. in Gard. Chron. n.s. 17: 558 (1882). Types: India, Assam, *Griffith* (syn. W); Myanmar (Burma), *Griffith* (syn. W); Myanmar, *Parish* (syn. W).

P. blumei var. *pulchra* King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 109, t.151 (1898). Type: India, Sikkim, *Pantling* 139 (holo.CAL, iso. BM! K! LE! W!).

Plant large, 60–200cm tall. *Pseudobulbs* conical to ovoid, green, sheathed by leaf bases, 2.5–6cm long. *Leaves* elliptic-lanceolate, acuminate, thin-textured, 30–100 × 8–20cm; petiole 15–25cm long. *Inflorescence* lateral, laxly 10-to 20-flowered; peduncle stout, terete, sheathed, 50cm tall; sheaths elliptic-lanceolate, 4–6cm long; rachis 18cm long; floral bracts spathe-like, caducous, c.5cm long. *Flowers* 10–12.5cm across; sepals and petals white, pale yellow, greenish or rosy on outer surface, reddish to yellow-brown with a golden margin (or rarely white) within, tube of lip pink to wine-red, or creamy-yellow, with a yellow base within, white without, mid-lobe orange, red or white and pink; pedicel and ovary 2.5–4.5cm long. *Sepals* and *petals* similar, spreading, lanceolate to oblanceolate, acuminate, 4.5–6.5 × 1–1.5cm. *Lip* tubular below, 3-lobed, spurred, obovate, acute or apiculate (or truncate), margin crisped-undulate, recurved, 3.5–5 × 2–4.5cm; callus obscurely 3-ridged, usually extending from base to apex (sometimes not reaching apex); *spur* slender, 0.6–1.5cm long. *Column* clavate, 2–2.2cm long. *Fruit* ellipsoid, long beaked, 5–7 × 1.5–3cm. **Plate 11.**

Bhutan: S – Phuntsholing district (Phuntsholing); **C** – Punakha (Rimchu to Khosa) and Mongar (Lhuntse Dzong) districts; **Terai** (Dulkajhar); **Sikkim** (Chunthang). In tropical valleys; 1300–1600m. Fl. (February–)April–May.

GENERAL DISTRIBUTION. India, Sri Lanka, Myanmar, SE Asia, China, Japan, Malaysia, Indonesia, New Guinea, Australia and the Pacific Islands.

ETYMOLOGY. Named in honour of the Countess of Tankerville who was an 'encourager of botany'.

NOTES. Seidenfaden (1986) outlined the history of this species which was introduced from China by Fothergill in 1778. L'Héritier de Brutelle was visiting England between 1786 and 1787 and described the species in *Sertum Anglicum* in 1789. In the protologue he wrote '*Banks icon abusque sermone*' presumably referring to a conversation with Joseph Banks who had seen a painting of the species. This painting by James Sowerby is dated 1787 and was used as the illustration in William Aiton's *Hortus Kewensis* published in 1789; now at the BM it is the type of the species.

Lindley described *P. veratrifolia* from Sylhet in 1831, with the comment that the description was based on a drawing by Wallich and an imperfect herbarium specimen. He stated that the sepals and petals were pale yellow and the lip yellow. We have examined the type specimen (K-LINDL) and find it to be indistinguishable from *P. tankervilleae* apart from the flower colour. In New Guinea pale yellow forms of *P. tankervilleae* are known (O'Byrne, 1994), and as the colour of the species is generally variable, we treat *P. veratrifolia* as conspecific with *P. tankervilleae*.

An extended synonymy can be found in Seidenfaden (1986).

69. Spathoglottis Bl.

Plants terrestrial. *Pseudobulbs* ovoid, subterranean. *Leaves* plicate, sheathing at base. *Inflorescence* lateral, racemose. *Flowers* showy. *Sepals* and *petals* subequal, similar, spreading. *Lip* strongly 3-lobed, sessile or shortly clawed; lateral lobes erect, oblong; mid-lobe spathulate; disc at base of mid-lobe tuberculate or crested. *Column* elongate, curved, clavate, winged, lacking a foot; pollinia 8, in 2 groups of 4.

The genus *Spathoglottis* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 53 species distributed in India, SE Asia, China, Indonesia, New Guinea, Australia and the Pacific Islands.

Howcroft (1986) reviewed the New Guinea species and followed Bentham & Hooker's treatment which placed the species in two series: Elatiores (with unthickened pseudobulbs, many-flowered inflorescence, and conspicuous floral bracts) and Tenuiores (with corm-like pseudobulbs, few-flowered inflorescences and small floral bracts).

TYPE. *Spathoglottis plicata* Bl..
ETYMOLOGY. From the Greek *spatho-* (spathe) and *glossa* (tongue) in allusion to the, usually, broadly oblong mid-lobe of the lip.

1. **S. ixioides** (D. Don) Lindl., Gen. Sp. Orchid. Pl.: 120 (1931). Type: Nepal, Gossainthan, *Wallich* s.n. (holo. BM!).
Cymbidium ixioides D. Don, Prodr. Fl. Nepal: 36 (1825).

Plant 5.5–22cm tall. *Pseudobulbs* globose-ovoid, fibrous-sheathed at base, 0.5–1.5 × 0.7–1.4cm. *Stem* sheathed at base, 0.4–2.5cm long; basal sheaths tubular, fibrose, 1–1.8cm long. *Leaves* 2 or 3, linear to oblong, acuminate, sessile, sheathing at base, 3.5–17 × 0.1–0.7cm. *Inflorescence* slender, erect, laxly 1- to 3-flowered; peduncle slender, bearing few sheaths; sheaths tubular, acute, 0.9–1cm long; rachis 1–4.5cm long; floral bracts ovate-lanceolate, acute, sheathing at base, 7–9mm long. *Flowers* 2–3cm across, bright yellow with small purple spots at base of lip; pedicel and ovary pubescent, clavate, 1.8–2.6cm long. *Sepals* similar, ovate-elliptic, subacute, 5-veined, spreading, 1.6–1.8 × 0.6–0.8cm. *Petals* elliptic, obtuse, spreading, 1.6–1.9 × 0.8–0.9cm. *Lip* 3-lobed, weakly saccate to concave at base, 1.5–1.6 × 0.6–0.7cm (at apex); lateral lobes falcately triangular, diverging, upper margins covering column base; mid-lobe narrowed at base, obcordate, apex obscurely 2-lobed, subtruncate; disc with 2 elongate, asymmetrical calluses. *Column* elongate, winged at apex. 1–1.1 × 0.3–0.4cm. **Fig. 70; Plate 11.**

Bhutan: S – Chukka district (S of Chima Kothi); C – Punakha (Khelekha, Tang Chu), Bumthang (near Bumthang, Bumthang Chu), Mongar (Pimi), Mongar/Tashigang (Donga La) and Tashigang (Tashi Yangtsi) districts; N – Upper Kulong Chu district (near Tobrang). **Sikkim** (Lachen, Lachung, Lhonak Valley, Rathang Chhu Valley between Mintok Khola and Paha Khola, Zemu Valley). On moist moss-covered rock in open *Pinus* and dense mixed forest, wet bank by roadside with scattered scrub, among matted roots of *Gaultheria* sp.; 1950–3650m. Fl. July–August.

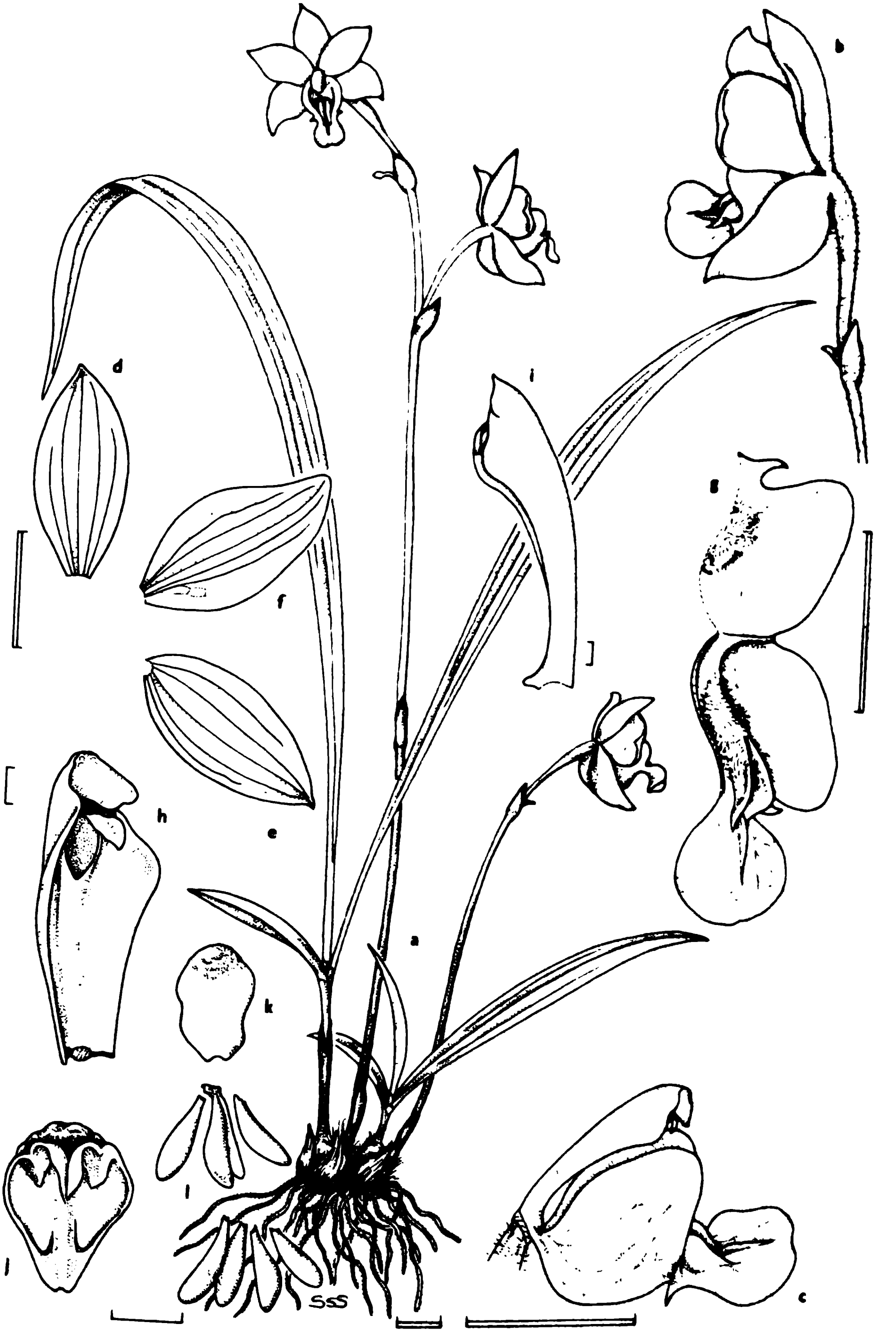


Fig. 70. **Spathoglottis ixioides**: a, habit; b, flower; c, lip and column; d, dorsal sepal; e, lateral sepal; f, petal; g, lip (side view); h, column (front view); i, column (side view); j, anther (front view); k, anther (back view); l, pollinia. Drawn by Susanna Stuart-Smith from Herb. Genavense 847385 (K).

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From *Ixia* (a genus in the family Iridaceae) and the Greek *-oides* (a resemblance to).
NOTES. *S. ixioides* is closely related to *S. pubescens* Lindl., another yellow-flowered species. The latter species is a larger plant with oblong lateral lobes of the lip, the upper margins of which lie below the column.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

S. **plicata** Bl., Bijdr.: 401. t.76 (1825). Type: Java, *Blume* s.n. (holo. L! Herb. no. 903162735, iso. P!).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

S. **pubescens** Lindl., Gen. Sp. Orchid. Pl.: 120 (1831). Types: Myanmar, Prome, coll. *Wallich* Wall. Cat. 3744A (syn. K-LINDL!, isosyn. K-W!); Myanmar, Toang Dong, coll. *Wallich* Wall. Cat. 3744B (syn. K-LINDL!, isosyn. K-W!); ?India, Mt. Sylhet, coll. *H. Bruce* Wall. Cat. 3744C (syn. K-LINDL!, isosyn. K-W!).
Spathglottis pubescens var. *parviflora* (Lindl.) Hook. f., Fl. Brit India 5(2): 814 (1890).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

Subtribe **Collabiinae** Schltr.

We follow Senghas (1984) and van der Burgh & de Vogel (1997) in our treatment of this subtribe.

70. **Chrysoglossum** Bl.

Plants terrestrial. *Pseudobulbs* either leaf- or inflorescence-bearing. *Leaf* single, convolute, petiolate. *Inflorescence* erect, few-flowered. *Flowers* resupinate, ± widely open, spreading. *Sepals* similar; lateral sepals inserted on the column foot. *Petals* equal. Lip mobile, 3-lobed, fleshy, clawed; lateral keels 2, not elevated, median keel high between the lateral lobes. Column erect, winged; column foot distinct; anther 2-celled; pollinia 2.

The genus *Chrysoglossum* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises four species distributed in NE India, Sri Lanka, China, Thailand, Cambodia, Taiwan, Malaysia, the Malay Archepelago, New Guinea and the Pacific Islands. Van der Burgh & de Vogel (1997) have monographed the genus and provided a full synonymy.

LECTOTYPE. *Chrysoglossum ornatum* Bl.
ETYMOLOGY. From the Greek *chryso-* (golden) and *glossa* (tongue) in reference to the flower colour of the type species.

1. *C.* **ornatum** Bl., Bijdr.: 338 (1825). Type: Java, Salak, Tjapus River, *Blume* s.n. (holo. L not located, iso. K!).
Ania maculata Thwaites, Enum. Pl. Zeyl.: 301 (1861). Type from Sri Lanka.
Chrysoglossum erraticum Hook. f., Fl. Brit. India 5(2): 784 (1890); Icon. Pl. 21: t.2062 (1892). Type: India, Darjeeling, Rishep, *Clarke* 12314 (holo. W!).
C. maculatum (Thwaites) Hook. f., *loc. cit.* 784 (1890).
Tainia maculata (Thwaites) Hook. f., *op. cit.* 821 (1890).

Plant to 60cm tall; roots 2–7 on each rhizome; *rhizome* c.20cm long. *Pseudobulbs* ovoid to tapering, terete, leaf-bearing ones 2.8–5.3 × 4–10cm, inflorescence-bearing ones 5–15 × 4–6cm; pseudobulb scales 0.6–2 × 0.4–0.6cm. *Leaf* lanceolate, acuminate, 17–32 × 5–7.5cm; petiole 6–21cm long.

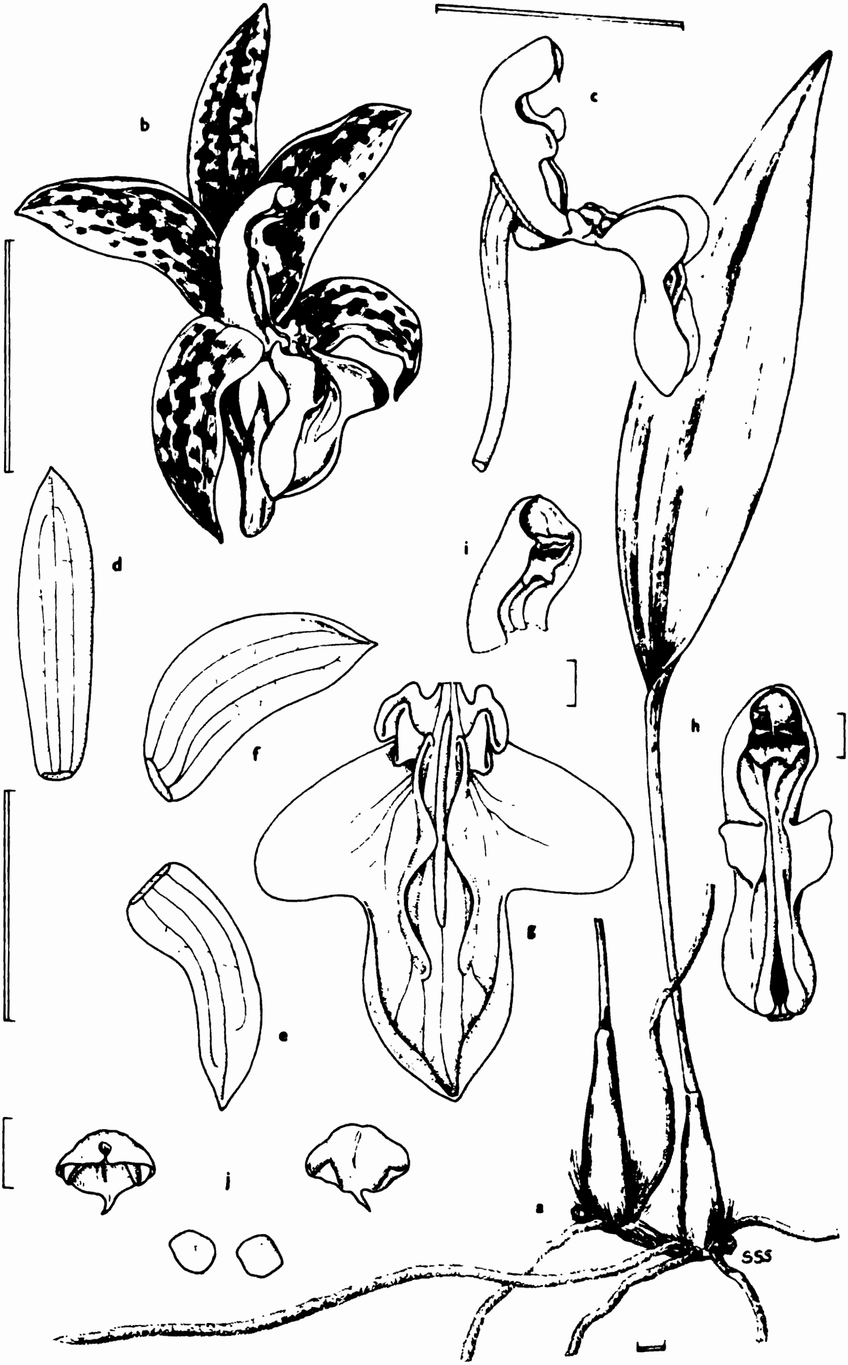


Fig. 71. **Chrysoglossum ornatum**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column; i, column apex; j, anther and pollinia (two views). *Drawn by Susanna Stuart-Smith.* a from *Hooker* s.n. (K); b–j from *Menzies & Du Puy* 471 (K).

Inflorescence 10–25-flowered; peduncle sheathed, 25–63cm long; peduncle glabrous, sheaths 2–5mm long; rachis glabrous, c.34.5cm long; floral bracts lanceolate-ovate, acute, spreading, 3- to 5-veined, 0.7–1.2 × 0.2–0.3cm. *Flowers* to 2cm long; sepals and petals green to yellow, lip white or yellowish with yellow keels, column white to yellow; pedicel and ovary 0.8–1.5 × 0.1–0.25cm. *Dorsal sepal* linear-lanceolate, acute, 3–5 veins, 1–1.9 × 0.2–0.4cm; *lateral sepals* narrowly triangular to lanceolate, weakly falcate, acute, 1–1.6 × 0.2–0.4cm. *Petals* lanceolate, weakly falcate, acute, 1–1.6 × 0.2–0.5cm. *Lip* 3-lobed, fleshy, clawed, 0.8–1cm long; lateral lobes rounded, entire; mid-lobe obovate, margins incurved to inrolled; disc 3-lamellate, fleshy, undulate, terminating at base of mid-lobe. *Column* slender to stout, 5–7.5 × 1–1.3mm; foot 1.5–2.7mm long. *Fruit* reflexed, ellipsoid, c.2.5–4mm long. **Fig. 71.**

Darjeeling (Rishep); **Sikkim** (Lachung Valley). 300–2700m. Fl. May–August.

GENERAL DISTRIBUTION. Sri Lanka, India, Thailand, Cambodia, Taiwan to the Malay Archipelago.
ETYMOLOGY. From the Latin *ornatus* (embellished) in reference to the lip lamellae.

71. Diglyphosa Bl.

Plants terrestrial, sympodial. *Pseudobulbs* either leaf- or inflorescence-bearing; pseudobulb scales tubular, membranous. *Leaf* usually solitary, petiolate. *Inflorescence* erect, racemose to paniculate, many-flowered. *Flowers* resupinate, opening simultaneously. *Sepals* similar; lateral sepals broadly inserted on column foot. *Petals* similar. *Lip* mobile, entire to 3-lobed; 2-keeled, converging. *Column* erect, slender; column foot simple, flat; anther cordate, 2-celled; pollinia 2, waxy.

The genus *Diglyphosa* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises two species distributed in NE India, Vietnam, the Malay Peninsula, Sumatra, Java, the Philippines, Sulawesi, Seram and New Guinea.

Van der Burgh & de Vogel (1997) have monographed the genus and provided a full synonymy.

TYPE. *Diglyphosa latifolia* Bl.
ETYMOLOGY. From the Greek *di-* (two, twice) and *glyphein* (to cleave) in reference to the apically bifid anther.

1. D. **latifolia** Bl., Bijdr.: 337 (1825). Type: Java, Meggamedong, *Blume* s.n. (holo. L!).
Diglyphis latifolia (Bl.) Miquel, F. Ned. Ind. 3: 654, 735 (1855).
Chrysoglossum latifolium (Bl.) Bentham & Hook. f., Gen. Pl. 3: 508 (1883).
C. macrophyllum King & Pantling in J. Asiat. Soc. Bengal 64(3): 335 (1896). Type: India, Darjeeling, Chel Valley, *Pantling* 315 (holo. CAL, iso. AMES! BM!).
Diglyphosa macrophylla (King & Pantling) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 98, t.136 (1898).

Plant tall; *roots* arising from rhizome between pseudobulbs; *rhizome* fleshy. *Pseudobulbs* cylindric, tapering, wrinkled when dry, bearing caducous scales, leaf-bearing 6.5–19 × 0.7–1.1cm, inflorescence-bearing 1–2 × 0.4–0.5cm. *Leaves* 1–3, elliptic to lanceolate, acute to acuminate, 5- to 8-veined, 20–37 × 7.5–16.5cm; petiole 8–33cm long. *Inflorescence* densely 30- to 80-flowered; peduncle sheathed, 10–28cm long; sheaths 1.5–3.5 × 0.4–0.8cm; rachis c.18cm long; floral bracts lanceolate, acuminate, 3-veined, 0.6–1.3 × 0.2–0.3cm. *Flowers* fragrant, most opening simultaneously; sepals and petals orange flushed and veined with purple, lip orange; pedicel and ovary star-shaped in section, 0.9–1.4 × 0.1–0.2cm. *Dorsal sepal* lanceolate, acuminate, incurved, 5-veined, 0.9–1.6 × 0.2–0.4cm; *lateral sepals* lanceolate, acuminate, falcate, 5-veined, 0.6–1.3 × 0.2–0.4cm. *Petals* ovate-lanceolate, acuminate, weakly falcate, 5-veined, 0.6–1.3 × 0.2–0.5cm. *Lip* simple, mobile, fleshy, oblong to obovate, slightly constricted in the middle, entire, 4–6 × 2–4mm; disc 2-keeled, fleshy, converging to a point 0.5–1.5mm from the apex. *Column* 3.5–5.6 × 0.8–1.2mm; foot simple, 1–1.5mm long. **Fig. 72.**

Darjeeling (Chel Valley). 1000–1500m. Fl. February–July.

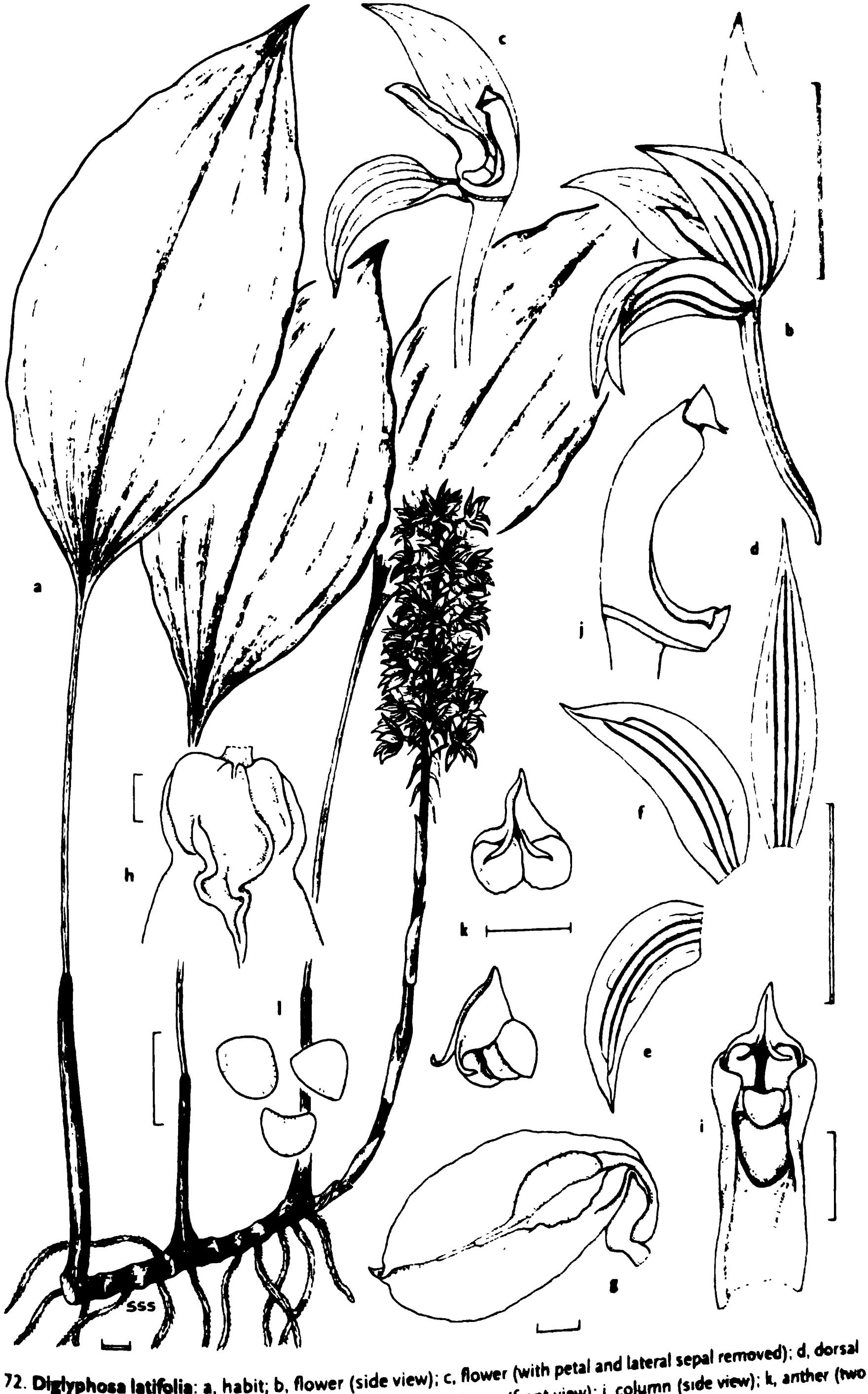


Fig. 72. **Diglyphosa latifolia**: a, habit; b, flower (side view); c, flower (with petal and lateral sepal removed); d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip base (detail); i, column (front view); j, column (side view); k, anther (two views); l, pollinia. Drawn by Susanna Stuart-Smith from *Comber* 1319 (K).

GENERAL DISTRIBUTION. NE India, the Malay Peninsula, Sumatra, Java, Sulawesi, the Philippines, Seram and New Guinea.

ETYMOLOGY. From the Latin *latus* (wide) and *-folius* (leaved).

NOTE. Jain & Mehrotra (1984) recorded *D. macrophylla* as endemic to Sikkim, but van der Burgh & de Vogel (1997) concluded that this species should be treated within the synonymy of *D. latifolia*.

72. **Mischobulbum** Schltr.

Plants terrestrial; *rhizome* creeping, unbranched; *roots* unbranched. *Pseudobulbs* cylindric, erect, swollen towards base, petiole-like. *Leaf* single, sessile, 3- to 5-veined. *Inflorescence* lateral arising from base of pseudobulb, erect, racemose, laxly to densely few-flowered; peduncle sheathed; floral bracts triangular, acute. *Flowers* resupinate. *Sepals* and *petals* subsimilar, entire; lateral sepals decurrent along column foot. *Lip* obscurely 3-lobed, slightly saccate, spurless; callus ridged. *Column* semi-terete, winged; pollinia 8, in 4 pairs.

The genus *Mischobulbum* was established in 1911 by Rudolf Schlechter in *Feddes Repertorium Specierum Novarum Beihest*. He later (in *Die Orchideen*, 1914) changed the spelling to Mischobulbon, a spelling that is considered to be an illegitimate orthographic variant. The genus comprises eight species distributed in SE Asia, the Malay Peninsula, Sumatra, Borneo to the Solomon Islands.

Turner (1992) has monographed the genus.

LECTOTYPE. *Mischobulbum scapigerum* (Hook. f.) Schltr.; basionym: *Nephelaphyllum scapigerum* Hook. f.

ETYMOLOGY. From the Greek *mischo-* (stalk) and *bolbos* (bulb) in reference to the stipitate pseudobulbs.

1. **M. megalanthum** T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 76 (1951). Type: India, Sikkim, *Pantling* 206 (holo. CAL, iso. FI K! W!).

Nephelaphyllum grandiflorum sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 104, t.144 (1898), *non* Hook. f.

Mischobulbum grandiflorum sensu Rolfe in Orchid Rev. 20: 127 (1912), *non* (Hook. f.) Schltr.

Plant 60–85cm tall; stem of sterile shoots with 2 internodes. *Pseudobulbs* erect, cylindric, 5.5–7.5 × 0.25–0.5cm. *Leaf* cordate, acuminate, veined, margin entire, mottled or marbled, 5- to 7-veined, 11.5–13.5 × 5.1–7.2cm. *Inflorescence* erect, 4- to 8-flowered; peduncle sheathed, glabrous, 12.5–18cm long; sheaths 3, 3.5–6cm long; rachis 4.5–10cm long; floral bracts spreading, triangular-lanceolate, 0.7–1.4cm long. *Flowers* showy; sepals and petals pale greenish-brown, veins dark brown, lip white with small pink spots, apex blotched pink, base yellow, column yellow; pedicel and ovary 0.9–1cm long. *Dorsal sepal* elliptic, acute, 5-veined, c.1.7 × 0.3cm; *lateral sepals* lanceolate, weakly falcate, acute, c.1.85 × 0.8cm, base broad. *Petals* obliquely elliptic, subacute, c.1.5 × 0.55cm. *Lip* elliptic, entire, glabrous, 3-keeled, 1.5–1.6cm long, median keel raised, plate-like, from base. *Column* clavate, margin weakly denticulate, winged, c.6.5mm long; foot 7–9mm long. *Fruit* ellipsoid, c.1.7cm long. **Fig. 73.**

Darjeeling (Sivok); **Sikkim** (unlocalised *Pantling* specimen). In tropical valleys; 300m. Fl. March.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Greek *megalo* (large) and *anthos* (flower).

NOTES. King & Pantling (1898) misapplied the name *Nephelaphyllum grandiflorum* Hook. f. to specimens from Sikkim. Rolfe corrected this mistake and proposed M. *grandiflorum* as a new name for these plants, but Schlechter had already made this combination for another species. Tang & Wang therefore proposed the name M. *megalanthum*.

Doubtfully recorded and imperfectly known species.

M. wrayanum (Hook. f.) Rolfe in Orchid Rev. 20: 127 (1912). Type: Malaysia, Gunong Batu Pateh, Perak, *Wray* 235 (holo. K!).

Ipsea wrayana Hook. f., Fl. Brit. India 5(2): 812 (1890).

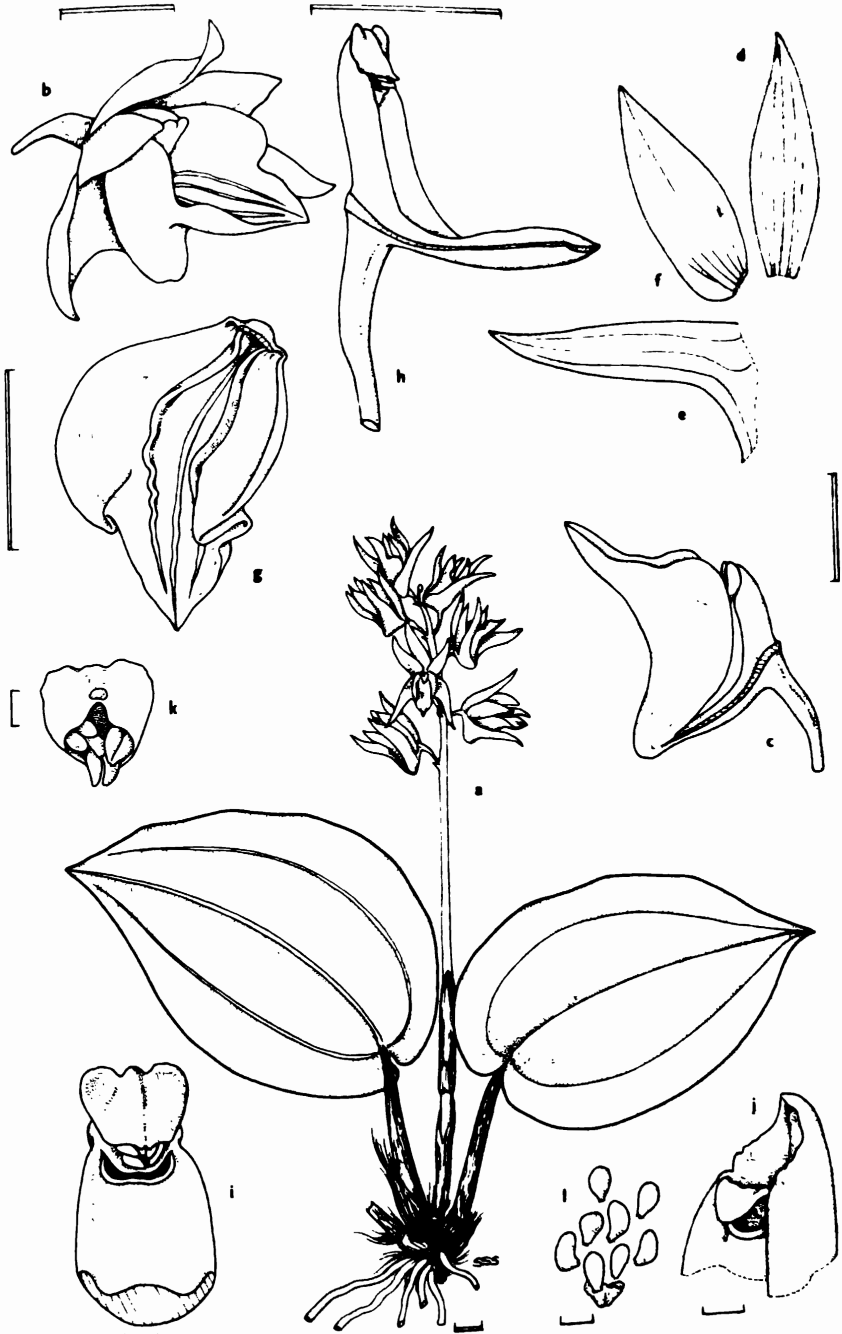


Fig. 73. **Mischobulbum megalanthum**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column; i, column apex; j, column apex (with anther removed); k, anther; l, pollinia. Drawn by Susanna Stuart-Smith, a from *Pantling* 206 (K); b–l from *Herman* 3619 (K).

NOTES. Bose & Bhattacharjee (1980) listed this species for Sikkim (Tista Valley). They described the sepals and petals as greenish with brown-purple veins and the lip with broad lateral lobes and white, flushed with purple and spotted and veined with pink. There are only two *Mischobulbum* species with lateral lobes, *M. cordifolium* (Hook. f.) Schltr. (found in China) and *M. wrayanum*. *M. wrayanum* has wine-red sepals and petals and a white lip with carmine-yellow markings (Turner, 1992). We have seen no material of this species and feel that further collections are required before its occurrence can be confirmed.

73. Nephelaphyllum Bl.

Plants terrestrial; *rhizome* creeping, rooting at nodes. *Pseudobulbs* slender, fusiform, scarcely distinct from the short petioles. *Leaf* single, slightly fleshy, weakly cordate. *Inflorescence* terminal or from base of pseudobulb, laxly or densely few-flowered. *Flowers* small to medium in size, non-resupinate. *Sepals* and *petals* subequal, acute, often reflexed. Lip entire to 3-lobed, shortly spurred; disc keeled. Column rather short, narrowly winged, lacking a foot; anther 2-horned; pollinia 8.

The genus *Nephelaphyllum* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 16 species distributed in NE India, through SE Asia to Indonesia.

LECTOTYPE. *Nephelaphyllum pulchrum* Bl.
ETYMOLOGY. From the Greek *nephalo-* (cloud) and *phyllon* (leaf) referring to the hazy opaqueness of the upper leaf surface.

Key to species

1. Lip 3-lobed; leaf petiolate .... **1. N. cordifolium**
+ Lip simple; leaf sessile .... **2. N. pulchrum** var. **sikkimensis**

1. N. cordifolium (Lindl.) Bl., Fl. Javae nov. ser. 1: t.61.3 (1858). Type: ?India, Montes Sillet, coll. F. De Silva Wall. Cat. 3750 (holo. K-LINDL!, iso. K-W!).
Cytheris cordifolia Lindl., Gen. Sp. Orchid. Pl.: 129 (1831).
Tainia cordifolia (Lindl.) Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 4: 706 (1932).

Plant 15–18cm tall; *rhizome* fleshy, creeping. *Pseudobulbs* elongate, 5.5–7cm long. *Leaf* ovate-cordate, acute, petiolate, 5-veined, green, mottled with purple, 5–10 × 4–7.5cm; petiole 1–3.2cm long. *Inflorescence* terminal, erect, laxly 3- to 6-flowered; peduncle glabrous, sheathed, 6–7cm long; sheaths membranous, lanceolate, 1.6–2cm long; rachis glabrous, 3–4cm long; floral bracts linear, caducous, 4–7 × 0.5–1mm. *Flowers* 1.5–2cm across; sepals and petals green, striped purple, lip yellow, column pale yellow; pedicel and ovary 7–9mm long. *Sepals* subequal, free, narrowly oblong, acute to acuminate, spreading to recurved, c.1 × 0.2cm. *Petals* narrowly oblong, acute, gibbous at base, c.8mm long. Lip 3-lobed, elongate to wedge-shaped, spurred, c.1.1 × 0.35cm; lateral lobes narrow, diverging, margins erose; mid-lobe broad, retuse; disc with 3 stout, spine-like, undulate lamellae; spur blunt, 2-lobed, c.3 × 2mm. Column c.4mm long. **Fig. 74.**

Darjeeling (Labha). 1500m. Fl. June.

GENERAL DISTRIBUTION. NE India and Bangladesh.
ETYMOLOGY. From *cordatus* (heart-shape) and *-folius* (leaved).

2. N. pulchrum Bl., Bijdr.: 373, t.36 (1825). Type: Java, Mt. Salak, *Blume* (holo. L, not found).
Nephelaphyllum latilabre Ridley in Trans. Linn. Soc. London 2(4): 238 (1894). Type from Malaysia.
N. borneense Schltr. in Bull. Herb. Boissier sér 2, 6: 301 (1906). Type from Borneo.
Tainia pulchra (Bl.) Gagnepain in Bull. Mus. Natl. Hist. Nat. sér. 2, 4: 706 (1932).

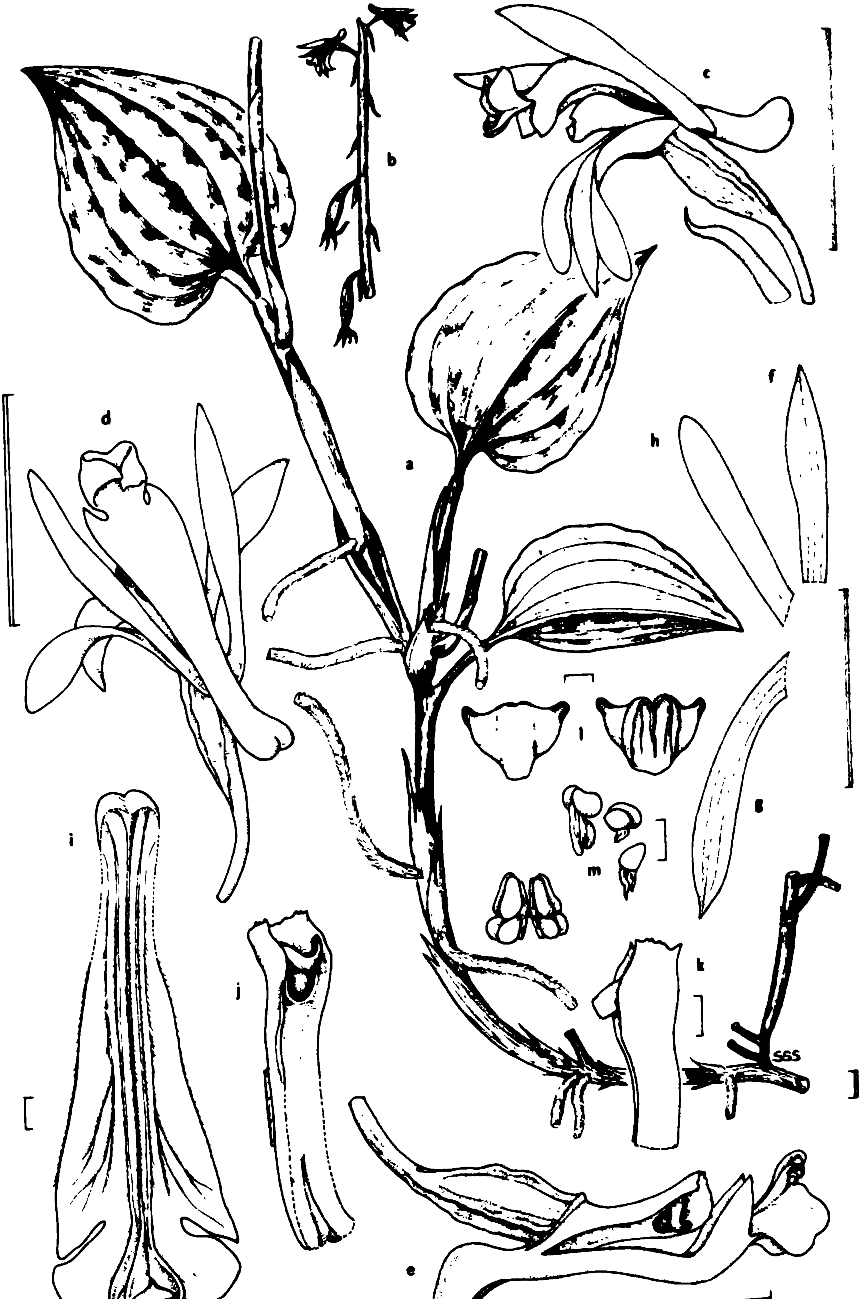


Fig. 74. **Nephelaphyllum cordifolium**: a, habit; b, inflorescence; c, flower with bract; d, flower (from below); e, lip, column and ovary; f, dorsal sepal; g, lateral sepal; h, petal; i, lip; j, column; k, column apex (side view); l, anther (two views); m, pollinarium and details. Drawn by Susanna Stuart-Smith, a–b from 'Khasia' 147 (K); b–m from *Wallich* 3750 (K-LINDL); n from t.146 in King & Pantling (1898).

T. borneensis (Schltr.) Gagnepain, loc. cit. (1932).
T. latilabra (Ridley) Gagnepain, loc. cit. (1932).

var. **sikkimensis** Hook. f., Fl. Brit. India 5(2): 819 (1890). Type: Bhutan, *Griffith* 5370 (syn. K!).
Nephelaphyllum sikkimensis (Hook. f.) S. Karthikeyan, Fl. Ind. Enumerat.-Monocot.: 154 (1989).

Plant terrestrial; *rhizome* creeping, fleshy. *Pseudobulbs* clustered, ovoid-cylindric, sheathed when young, 1.5–3.5 × 0.2–0.5cm. *Leaf* broadly ovate-cordate to ovate-lanceolate, fleshy, upper surface brownish-green mottled with purple, lower surface deep purple, 7.5–10 × 4–6cm. *Inflorescence* from pseudobulb base, compact, few-flowered; peduncle sheathed; rachis fleshy; floral bracts ovate-lanceolate. *Flowers* with sepals and petals red, lip base red, apex yellow, spur yellow. *Sepals* linear-oblong, acute, reflexed, margins crenulate. *Petals* linear-oblong, acute. *Lip* simple, appressed to column, broadly oblong, emarginate, margins minutely crenulate, spurred; disc with a thickened median band expanding into 3-dentate ridges at apex; *spur* 2-lobed, clavate, c.5mm long. *Column* narrowly winged.

Bhutan (unlocalised *Griffith* specimen); **Darjeeling** (unlocalised *Pantling* specimen and icon. at Kew). 500–1200m. Fl. June–August.

GENERAL DISTRIBUTION. E Himalaya.
ETYMOLOGY. From Sikkim where some of the syntype material originated.
NOTE. King & Pandling (1898) maintained this variety on the basis of the swollen pseudobulb bases and the slight variation in floral size and colour.

74. Tainia Bl.

Plants terrestrial, rarely epiphytic, creeping. *Pseudobulb* of a single internode, erect, cylindric to ovoid, bearing 1 leaf. *Leaf* elliptic to ovate, petiolate. *Inflorescence* terminal or lateral; peduncle sheaths tubular, acute; floral bracts triangular. *Flowers* resupinate, opening simultaneously. *Sepals* and *petals* ± triangular to ovate-elliptic; lateral sepals slightly decurrent along column foot. *Lip* 3-lobed, spurless. *Column* semi-terete, foot distinct; anther with 2 crests (abaxially); thecae 2, 4-celled; pollinia 8, in 4 pairs. Fruit ellipsoid.

The genus *Tainia* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indie*. The genus comprises 14 species distributed in India, Myanmar, China, Japan, Thailand, Vietnam, the Malay Archipelago to Australia and Bougainville.

Turner (1992) monographed the genus and accepted it as distinct from *Ania*. Seidenfaden (1992) was not convinced that such a division was justified and combined them in a single genus. Turner stated that the main difference between *Tainia* and *Ania* was that the former always had cylindric pseudobulbs usually consisting of one internode, usually terminal inflorescescences, an (at most) slightly saccate lip and no joint on the petiole. *Ania* has swollen, gourd-shaped to ovoid-ellipsoid pseudobulbs, usually of several internodes, lateral inflorescences, a usually distinctly spurred lip and a jointed petiole. We follow Turner's treatment here, but there clearly remains some doubt about the validity of accepting two genera.

TYPE. *Tainia speciosa* Bl.
ETYMOLOGY. From the Greek *tainia* (a fillet) in reference either to the long narrow leaves with unusually long petioles, or to the elevated keels on the lip.

Key to species

1. Lip 2- or 3-keeled .... **1. T. latifolia** subsp. **latifolia**
+ Lip 5-keeled .... **2. T. minor**

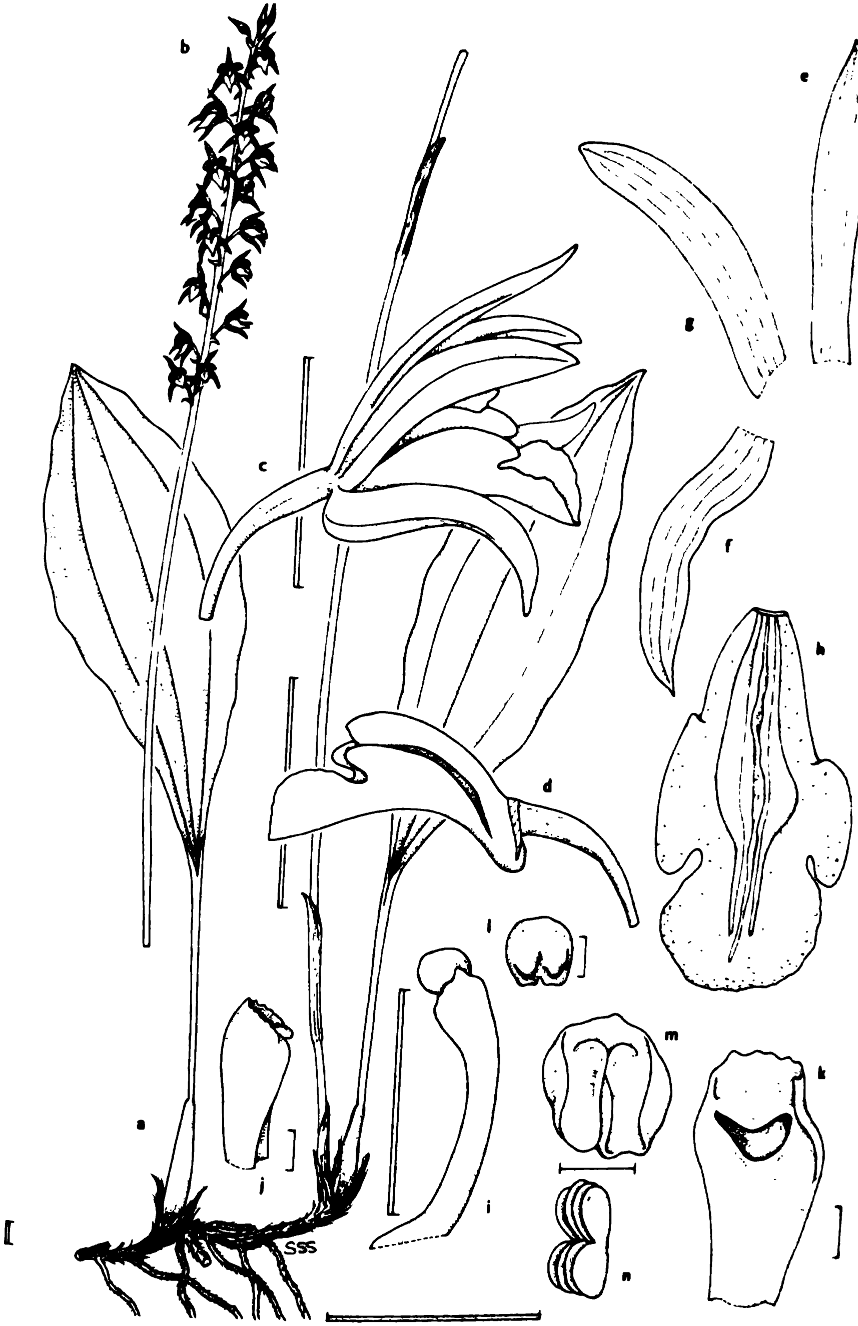


Fig. 75. **Tainia latifolia**: a, habit; b, inflorescence; c, flower; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column; j, column apex (side view); k, column apex; l, anther cap (from above); m, anther cap (from below); n, pollinia. Drawn by Susanna Stuart-Smith, a–m from *Pavey* 126 (K); n, based on icon. in King & Pantling (1898).

1. **T. latifolia** (Lindl.) Rchb. f. in Bonplandia 5: 54 (1857). Type: ?India, Montes Sillet, coll. H. *Bruce* s.n. Wall. Cat. 3741 (holo. K-W!).

Ania latifolia Lindl., Gen. Sp. Orchid. Pl.: 130 (1831).

Mitopetalum latifolium (Lindl.) Bl., Mus. Bot. 2: 185 (1856).

Eulophia hastata Lindl. in J. Proc. Linn. Soc., Bot. 3: 25 (1859). Type: India, Assam, *Griffith* s.n. (holo. K-LINDL!).

Tainia hastata (Lindl.) Hook. f., Fl. Brit. India 5(2): 821 (1890).

T. khasiana Hook. f., *loc. cit.* (1890). Type: India, Khasia Hills, *Hooker & Thomson* 217 (holo. K!).

T. cordata Hook. f., *op. cit.* 6(1): 193 (1890). Type: India, Sikkim, icon. (holo. CAL).

subsp. **latifolia**

Plant 90–150cm tall. *Pseudobulbs* cylindric-ovoid, swollen towards base, 6–9 × 0.3–1.2cm. *Leaf* elliptic to ovate-obovate, acute to acuminate, margins entire, many-veined, 15–42 × 4.6–10cm; petiole 6.5–25cm long. *Inflorescence* arising from above base of pseudobulb, 20- to 40-flowered; peduncle 50–64cm long; rachis 13–29cm long; floral bracts triangular, spreading to reflexed, 0.2–1.2cm long. *Flowers* opening simultaneously; sepals and petals greenish with red to chocolate brown veins, lip pale cream-white; pedicel and ovary 0.6–1.9cm long. *Dorsal sepal* elliptic to obovate, acute to obtuse, 1–1.8 × 0.1–0.3cm; *lateral sepals* elliptic to triangular, acute to obtuse, 0.9–1.7 × 0.15–0.3cm. *Petals* obliquely elliptic-obovate, subacuminate to obtuse, 0.9–1.8 × 0.15–0.3cm. *Lip* 3-lobed, elliptic, 0.8–1.2 × 0.4–0.9cm; lateral lobes obliquely triangular, obtuse to subacuminate; mid-lobe orbicular to transversely elliptic, apex retuse to acuminate, margins entire to weakly undulate; callus 2- or 3-keeled. *Column* apex entire to weakly denticulate, 5–9mm long; column foot 1–2.5mm long. **Fig. 75.**

Sikkim (unlocalised *Pantling* specimens). In tropical valleys and forest; 500–1500m. Fl. March.

GENERAL DISTRIBUTION. NE India, Bangladesh, Myanmar, China (Yunnan), Thailand, Laos and Vietnam.

ETYMOLOGY. From the Latin *latus* (broad, wide) and *folius* (leaf).

2. **T. minor** Hook. f., Fl. Brit. India 5(2): 821 (1890); Icon. Pl. 21: t.2091 (1892). Type: India, Darjeeling, Mahalderam, *Clarke* 35517 (holo. K!, iso. BM! G).

Plant 22–50cm tall. *Pseudobulbs* cylindric, expanded at base, scale-bract at apex persistent, 2.5–6.5 × 0.3–0.6cm. *Leaf* elliptic, acuminate, thin, many-veined, 13–23 × 2.6–5.6cm; petiole 4.5–7.5cm long. *Inflorescence* terminal, 5- to 16-flowered; peduncle sheathed, 15–32.5cm long; sheaths 3 or 4; rachis 7–18cm long; floral bracts spreading, triangular, 0.3–1.8cm long. *Flowers* mostly opening simultaneously; sepals and petals yellow to dull brownish-green, lip yellow; pedicel and ovary 0.5–2cm long. *Dorsal sepal* elliptic-ovate, obtuse to subacute, 1.2–1.8 × 0.1–0.3cm; *lateral sepals* elliptic, falcate, obtuse to subacute, 1–1.7 × 0.1–0.3cm. *Petals* obliquely elliptic to obovate, weakly falcate, obtuse, 1.1–1.7 × 0.2–0.4cm. *Lip* 3-lobed, elliptic, 0.9–1.4 × 0.6–0.8cm; lateral lobes obliquely triangular, weakly falcate, obtuse; mid-lobe orbicular to transversely elliptic to wedge-shaped, margins entire, glabrous; callus 5-keeled, glabrous, thickened. *Column* winged, 6.5–8mm long; foot 1.5–2mm long.

Darjeeling (Lapcha, Mahaldiram, Senchal); **Sikkim** (Chunthang). Shady places, in deep forest; 2000–2300m. Fl. May.

GENERAL DISTRIBUTION. NE India, Myanmar and China (Yunnan).

ETYMOLOGY. From the Latin *minor* (smaller).

Tribe **Coelogyneae** Pfitzer

Subtribe **Thuniinae** Schltr.

We follow Senghas (1984) in our treatment of this subtribe.

75. Arundina Bl.

Plants terrestrial. *Stems* slender, erect, leafy, often swollen at base, lacking pseudobulbs. *Leaves* grass-like, sheaths overlapping. *Inflorescence* terminal, racemose or paniculate, flowers opening in succession, one or two at a time. *Flowers* resupinate, large and showy. *Sepals* free, narrow; dorsal sepal erect; lateral sepals close together behind lip. *Petals* free, spreading, broad. *Lip* trumpet-shaped, lacking a spur; lateral lobes enclosing the column; apex emarginate; disc 3-keeled. *Column* lacking a foot; pollinia 8.

The genus *Arundina* was established in 1825 by Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises up to five species distributed in Sri Lanka, India, SE Asia, China, Malaysia and the adjacent islands.

Dressler (1993) included this subtribe within his 'misfits and leftovers'. Szlachetko (1995) included the subtribe Arundiinae within the tribe Bletiineae. We follow Dressler (1993) in leaving Bletiinae as a subtribe of the Arethuseae.

Van der Pijl (1954) reported pollination of *Arundinia speciosa* Bl. by carpenter bees of the genus *Xylocopa*.

LECTOTYPE. *Arundina speciosa* Bl.

ETYMOLOGY. From the Latin *arundo* (a reed), in reference to the stems.

1. **A. graminifolia** (D. Don) Hochreutiner in Bull. New York Bot. Gard. 6: 270 (1910). Type: Nepal, Suembu, *Buchanan-Hamilton* s.n. (holo. BM!, iso. LINN! Herb. no.1397:38).

Cymbidium bambusifolium Roxb., Hort. Beng.: 63 (1814), *nom. nud.*; Fl. Ind. ed. 1832: 460 (1832). Type: Bangladesh, Chittagong, *J. Roxburgh* (holo. probably lost); Lectotype (selected here): [icon. of] '*Cymbidium bambusifolium*' Roxburgh 2336 (holo. CAL, iso. K!).

Bletia graminifolia D. Don, Prodr. Fl. Nepal: 29 (1825).

Arundina chinensis Bl., op. cit. 402 (1825). Type: China, cult. (holo. L, not found).

Limodorum graminifolium Buchanan-Hamilton ex D. Don., Prodr. Fl. Nepal.: 30 (1825), *pro. syn.*

Arundina bambusifolia (Roxb.) Lindl., Gen. Sp. Orchid. Pl.: 125 (1831).

A. minor Lindl., loc. cit. (1831). Type from Sri Lanka.

A. densa Lindl. in Bot. Reg. 28: misc.25, no.26 (1842). Type from Singapore.

A. affinis Griff., Not. Pl. Asiat. 3: 330 (1851). Type: India, Khasia, *Griffith* s.n. (holo. K-LINDL!).

A. philippi Rchb. f. in Linnaea 25: 227 (1852). Type: China, *Fortune* s.n. (syn. W! no. 50460).

A. pulchra Miquel in J. Bot. Néerl. 1: 90 (1861). Type: China, *Miquel* s.n. (holo. U).

Plant to 3m tall. *Stem* erect, cane-like, leafy throughout, 0.7–1.3cm wide. *Leaves* distichous, linear-lanceolate, acuminate, sessile, bases clasping, 8.5–24 × 0.7–2.5cm. *Inflorescence* erect, racemose or paniculate, few- to many-flowered; peduncle glabrous, intermittently sheathed; rachis glabrous, 12–23cm long; floral bracts lanceolate, acute, 0.6–1 × 0.4–0.5cm. *Flowers* 4 × 4cm, magenta to pinkish-white, sometimes with a yellow throat; pedicel and ovary c.3cm long. *Sepals* similar, narrowly ovate to ovate-lanceolate, acute, 3.4–5 × 0.6–1cm. *Petals* spreading, broadly elliptic, obtuse, 3.3–4.1 × 1.3–1.6cm. *Lip* 3-lobed, 4–6 × 2.5–3.6cm; lateral lobes enfolding column, semi-ovate; mid-lobe recurved, 2-lobed in front, margins crenulate; disc with 3 to 5 parallel keels, fleshy. *Column* slender, erect, angular, 2–2.5cm long. Fruit long-ellipsoid, 3.5–7 × 0.8–1.5cm. **Fig. 76; Plate 12.**

Bhutan: S – Sarbhang (15km above Sarbhang) and Deothang (10km above Samdrup Jongkhar) districts; C – Punakha (Wangdi Phodrang), Tongsa (above Dakpai, Shemgang, Tingtinbi), Mongar (Lhuntse) and Tashigang (Gamri Chu valley) districts; **Terai** (Falakata); **Darjeeling** (near Bara Mangura (field record), Happy Valley, Kalimpong, Sivok); **Sikkim** (Gangtok (field record), Great Rangit River, Rimbi Chhu, Tista River). In tropical valleys, dry roadside banks, among bamboo, in hot mixed forest and open spaces on hillsides, in tall grass, in scrub jungle on sandy soil; 200–2160m. Fl. January–November; Fr. May–September.

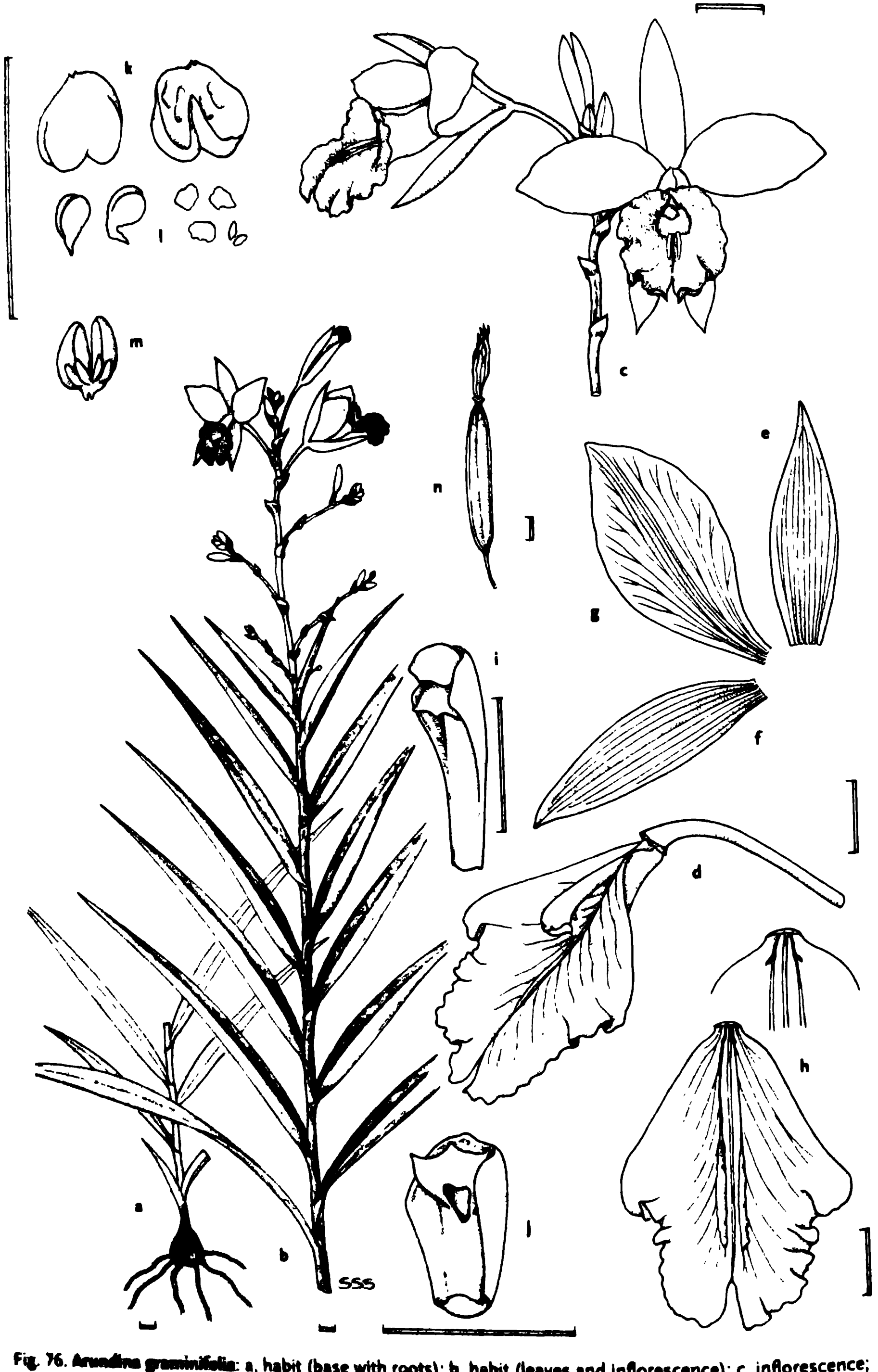


Fig. 76. **Arundina graminifolia**: a, habit (base with roots); b, habit (leaves and inflorescence); c, inflorescence; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip (with detail of base); i, column; j, column apex; k, anther (two views); l and m, pollinia (details); n, fruit. Drawn by Susanna Stuart-Smith, a from *Parry* 247 (K); b–l from *Grierson & Long* 1708 (K); m from Icon. in King & Pantling (1898); n from *Grierson & Long* 2144 (K).

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China, through SE Asia, Sri Lanka, Malaysia, Indonesia to the Pacific Islands.

ETYMOLOGY. From the Latin *gramineus* (grass-like) and *folius* (leaf).

NOTE. An extended synonymy can be found in Seidenfaden (1986).

76. Thunia Rchb. f.

Plants epiphytic or terrestrial, medium to large, lacking pseudobulbs. *Stems* fasciculate, erect, biennial, sheathed below and leafy above. *Leaves* distichous, sessile below. *Inflorescence* terminal, on young leafy shoots, racemose; floral bracts large, spathe-like, persistent. *Flowers* short-lived, large, showy. *Sepals* and *petals* subsimilar, free. *Lip* entire, spurred, fringed on front margin; disc with 5–7 lamellae or fringes; spur short, obtuse. *Column* slender, semi-terete at apex, 2-winged; pollinia 4, 2-lobed.

The genus *Thunia* was established in 1852 by Heinrich Gustav Reichenbach (1823–1889) in the *Botanische Zeitung*. It comprises about six species distributed in India, China and SE Asia.

The genus is related to *Phaius* but differs in lacking pseudobulbs, in having biennial stems and persistent bracts.

The pollination syndrome is unknown but Dressler (1993) suggested that bee pollination was likely, based on the floral structure.

TYPE. *Thunia alba* (Lindl.) Rchb. f.; basionym: *Phaius albus* Lindl.

ETYMOLOGY. Named after Count von Thun Hohenstein of Tetschin, Bohemia, a collector of orchids.

Key to species

1. Lip with a patch of yellow .... **1a. T. alba** var. **alba**
+ Lip lacking a yellow patch .... **1b. T. alba** var. **bracteata**

1. T. alba (Lindl.) Rchb. f. in Bot. Zeitung (Berlin) 10: 764 (1852). Type: ?India, Montes Sillet, coll. F. De Silva Wall. Cat. 3749B (holo. K-LINDL!, iso. K-W!).
Phaius albus Lindl. in Wall., Pl. Asiat. Rar. 2: 85, t.198 (1831).

1a. var. **alba**

Plant epiphytic or terrestrial, 30–100cm tall. *Stem* stout, erect; basal sheaths tubular, ovate, acute, 1.5–2.5cm long. *Leaves* many, narrowly elliptic-lanceolate to oblong-lanceolate, acuminate, membranous, glaucous beneath, 10.5–26 × 2–3.6cm. *Inflorescence* pendent, 4- to 8-flowered; peduncle short, sheathed, 2–6cm long; sheath 1, lanceolate, acute, tubular, c.4cm long; rachis short, 2–4cm long; floral bracts large, oblong, boat-shaped, acute, 4–5.5 × 0.8–1.2cm. *Flowers* 4–5cm long; sepals and petals white, lip white, with large yellow patch on basal half, veined yellow-orange, keels orange-yellow; pedicel and ovary 1–1.5cm long. *Sepals* free, subequal, narrowly oblong-ovate, acute to obtuse, 4.5–6 × 1–1.3cm. *Petals* oblong, acute, 4.5–5.5 × 0.7–0.9cm. *Lip* simple, broadly oblong-pandurate (when spread), spurred at base, 4.5–5 × 2.5–4.5cm (at base); basal half convolute into a tube; apical half hooded, margins dentate-undulate; disc with 5 to 9 dentate-fimbriate ridges; spur 1.4–1.5 × 0.2–0.3cm. *Column* expanded and winged at apex, 1.3–1.4cm long; foot short. *Fruit* narrowly ellipsoid, 3–3.5 × 0.9–1cm. **Fig. 77a–l; Plate 12.**

Bhutan: S – Samchi (Tamangdhanra) and Gaylegphug (Tatapani) districts; **C** – Bumthang district (near Bumthang (M.F.B.)); **Darjeeling** (Pankhabari, near Rambi Chhu); **Sikkim** (Rhenok?). On trees in thinned subtropical broad-leaved forest slope, on *Tiliaceae*; 660–2000m. Fl. March–August(–November).

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China (Yunnan), Thailand and Malaysia.

ETYMOLOGY. From the Latin *albus* (white).

NOTE. Seidenfaden (1986) reviewed the taxonomic position of this species and concluded that the original Wallich collection (3749 in K-LINDL) consisted of two distinct taxa and that 3749B should be considered as the type.

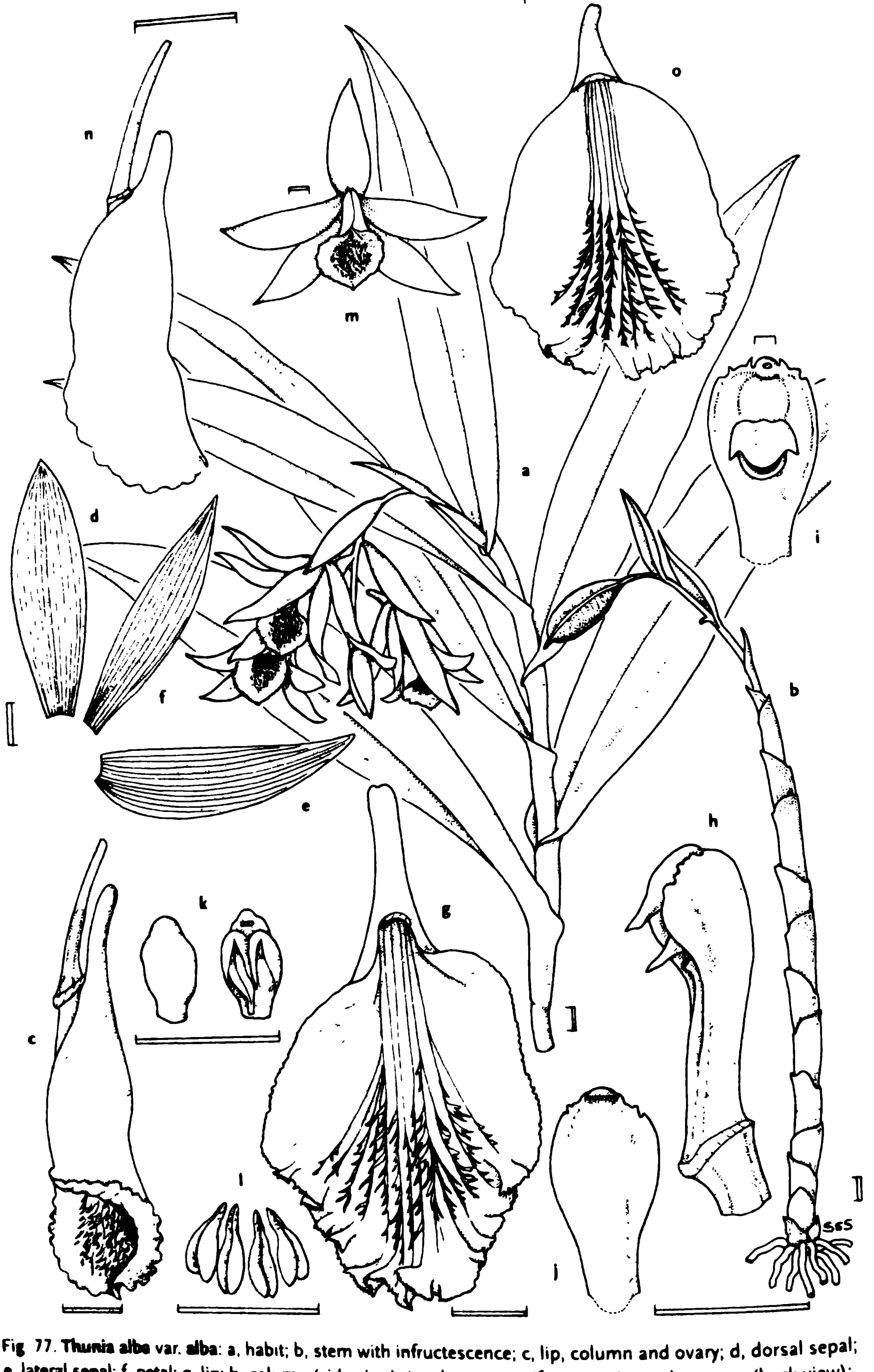


Fig. 77. **Thunia alba** var. **alba**: a, habit; b, stem with infructescence; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (side view); i, column apex (front view); j, colum apex (back view); k, anther (two views); l, pollinia. **T. alba** var. **bracteata**: m, flower; n, lip and column; o, lip. Drawn by Susanna Stuart-Smith, a from *Pantling* 81 (K); b from *Meebold* s.n. (K); c–l from *Schilling* 2462 (K); m from icon. Herklots '1962' (K); n–o from *Wallich* 3749A (K).

1b. var. **bracteata** (Roxb.) N. Pearce & P.J. Cribb in Edinb. J. Bot. 58(1): 116 (2001). Type: India, Meghalaya, Garrow Hills, M.R. Smith s.n. (holo. probably lost); Neotype: Nepal, Chandagherry, coll. Wallich Wall. Cat. 3749A (neo. K-LINDL!, isoneo. K-W!, designated by Seidenfaden in Opera Bot. 89: 12 (1986)).

Limodorum bracteatum Roxb., Hort. Bengal.: 63 (1814), nom. nud.; Fl. Ind. ed.1832(3): 466 (1832).

Thunia bracteata (Roxb.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 205 (1919).

T. venosum Rolfe in Orchid Rev. 13: 206 (1905). Type: India, Sikkim, Pantling 171 (holo. CAL, iso. BM! K! W!).

Differs from var. *alba* in having the lip lacking any yellow colouration, but with mauve-purple veins. **Fig. 77m–o; Plate 12.**

Bhutan: S – Samchi district (Tamangdhanra); **Sikkim** (unlocalised Pantling specimen). Thinned subtropical forest slope; 660–1600m.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Latin *bracteatus* (having bracts).
NOTES. There has been considerable debate as to the identity of this taxon since Rolfe (1905) separated *T. venosum* from plants previously grouped under *Phaius albus* Lindl. Seidenfaden (1986) reviewed the position and Pearce, Cribb & Renz (2001) reconsidered the problem and proposed the solution followed here. Seidenfaden (1986) proposed the above neotypification for the species because he thought the original collection from the Garrow Hills was lost, however there is a specimen at BM (Roxburgh 1645) which might well be considered as type material.

Subtribe **Coelogyninae** Bentham

77. **Bulleyia** Schltr.

Plants epiphytic, pseudobulbous. *Leaves* apical from pseudobulb, oblong-lanceolate. *Inflorescence* arising from apex of pseudobulb, zigzag, 10- to 15-flowered. *Flowers* resupinate. *Sepals* subsimilar, oblong; *lateral sepals* oblique, base widened. *Petals* oblong. *Lip* spurred, simple, constricted centrally; *spur* curved, porrect, cylindric. *Column* slender, dilated at apex; anther weakly reniform, hooded, short; pollinia 4, compressed, oblique, obovate.

The genus *Bulleyia* was established in 1912 by Friedrich Richard Rudolf Schlechter (1872–1925) in *Notes from the Royal Botanic Garden, Edinburgh*. It is a monotypic genus distributed in NE India and China (Yunnan). The genus is closely related to *Pholidota* Lindl. but differs in having a spur at the base of the lip.

TYPE. *Bulleyia yunnanensis* Schltr.
ETYMOLOGY. Named after Arthur Kilpin Bulley (1861–1942), a British nurseryman considered to have been 'the first of the great twentieth century patrons of plant collecting'. He engaged George Forrest (1873–1932) to travel and collect plants in China.

1. B. yunnanensis Schltr. in Notes Roy. Bot. Gard. Edinburgh 5: 108, t.82 (1912). Type: China, Yunnan, Tali Range, Forrest 4879 (holo. E!, iso. BM!).

Plant erect, 30–35cm tall; *rhizome* bearing crowded pseudobulbs; *roots* filiform, elongate. *Pseudobulbs* ovoid-conical, rugose-grooved, 3–4 × 1–2cm. *Leaves* 2, erect, shortly petiolate, oblong-lanceolate, acuminate, 20–26 × 1.4–2.2cm; petiole grooved, 5–9cm long. *Inflorescence* laxly 10- to 15-flowered; peduncle slender, glabrous, 20–30cm long; rachis glabrous, 7–14cm long; floral bracts to 2 x 1.2cm, ovate, subacute, papery. *Flowers* to 2cm long, uniformly yellowish; pedicel and ovary glabrous, clavate, c.4mm long. *Sepals* subsimilar, ovate-oblong, apiculate, glabrous, c.2cm long; *lateral sepals* oblique, wide based. *Petals* elliptic-oblong, oblique, acute to apiculate, glabrous, c.2cm long. *Lip* simple,

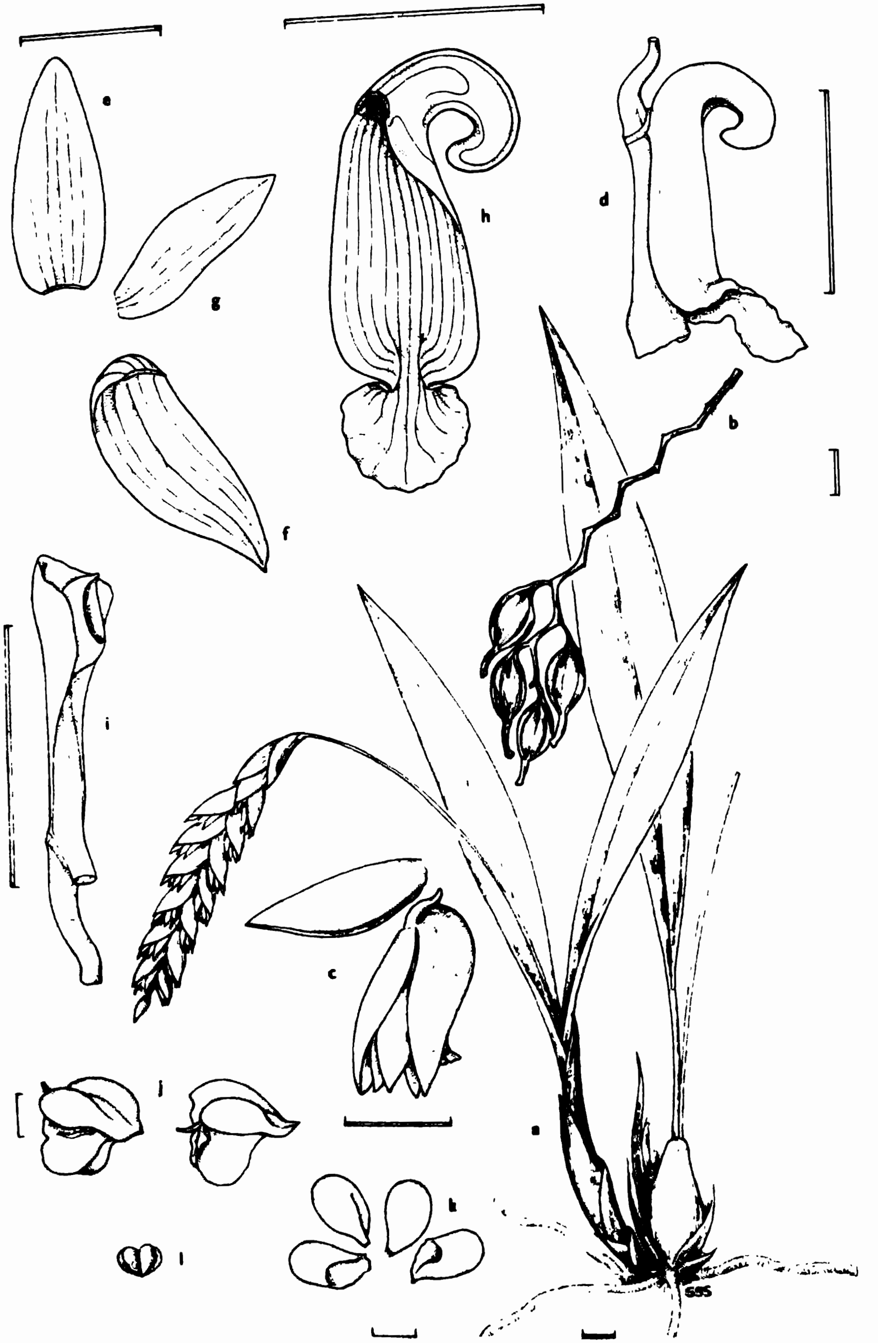


Fig. 78. ***Bulleyia yunnanensis***: a, habit; b, infructescence, c, flower with bract; d, lip, column and ovary; e, dorsal sepal, f, lateral sepal; g, petal; h, lip; i, column; j, anther (two views); k–l, pollinia. Drawn by Susanna Stuart-Smith, a, c–k from *Forrest* 4879 (E); b, from *Forrest* 26704 (K); l from icon. Schlechter (K).

spurred, deeply constricted in the middle, c.2cm long; basal section ovate-elliptic, concave at base; apical section reniform, emarginate, margins undulate; with 3 thickened, keeled veins on the isthmus; spur cylindric, curved-porrect, arising from between the sepals. *Column* glabrous, 1–2cm long. *Fruit* erect, ellipsoid, 1–1.8 × 0.6–1cm. **Fig. 78.**

Bhutan: (Nayar & Sastry, 1988); **Darjeeling** (on way to Sandakphu, 32km NW of Darjeeling (Kataki & Sastry, 1965)). On trunks of trees and humus-covered boulders in mixed forest.

GENERAL DISTRIBUTION. NE India and China (Yunnan).
ETYMOLOGY. From the province of Yunnan in China.

78. **Coelogyne** Lindl.

Plants epiphytic or lithophytic. *Pseudobulbs* ovoid, conical or cylindric, close or distant on rhizome, 1- or 2-leaved from apex. *Leaves* narrow to broad, elliptic to lanceolate, plicate, usually petiolate. *Inflorescence* erect or pendent, 1- to many-flowered. *Flowers* resupinate, small to large and showy, opening simultaneously or one at a time. *Sepals* free, often concave. *Petals* free, usually narrower than the sepals. *Lip* 3-lobed, concave at base; lateral lobes erect on either side of the column; mid-lobe spreading; disc keeled, lamellae often extending onto mid-lobe. *Column* long; anther ventral at column apex; rostellum large; pollinia 4.

The genus *Coelogyne* was established in 1821 by John Lindley in his *Collectanea Botanica*. The genus comprises over 100 species distributed in India, China, SE Asia, the Malay Archipelago and the Pacific Islands.

Pfitzer & Kränzlin (1907) monographed the genus and proposed a sectional treatment which Seidenfaden (1975c) revised. Clayton (in press) has reviewed the genus and we follow this treatment here.

The pollination syndrome is unknown, but Dressler (1981, 1993) reported wasp pollination for *C. fragrans* Schltr. and noted that the floral structure suggested bee pollination.

LECTOTYPE. *Coelogyne nitida* Lindl. (= *C. punctulata* Lindl.), designated by Hallé in Aubréville & Leroy, *Flore de la Nouvelle Caledonie et Dépendances*.
ETYMOLOGY. From the Greek *coelo-* (hollow) and *-gynus* (woman, pistil) in reference to the deeply excavated stigma.

Key to species

1. Plants 1-flowered .... **9b. C. occultata** var. **uniflora**
+ Plants more than 1-flowered 2

2. Flowers opening successively 3
+ Flowers opening simultaneously 5

3. Dorsal sepal less than 2.4cm long .... **1. C. fimbriata**
+ Dorsal sepal more than 2.7cm long 4

4. Lateral keels of lip low and straight on the hypochile .... **2. C. fuliginosa**
+ Lateral keels of lip undulate on the hypochile .... **3. C. ovalis**

5. Inflorescence with close, distichous sheaths between apex of peduncle and base of rachis ... 6
+ Inflorescence lacking sheaths between apex of peduncle and base of rachis 11

6. New growth extension annual with distichous sheaths between new and old growth; sheaths less than 5mm long 7
+ New growth extension not annual; sheaths more than 5mm long 10

7. Lip basally 3-keeled, white .... **16. C. raizadae**
+ Lip 2-keeled, yellow, brownish-yellow or brown 8

8. Lip brownish-yellow to brown .... **17. C. schultesii**
+ Lip yellow 9

9. Pseudobulb narrowly cylindric .... **14. C. longipes**
+ Pseudobulb globose-ovoid .... **15. C. prolifera**

10. Disc with 3 keels; lip margins fimbriate .... **12. C. barbata**
+ Disc with 2 keels; lip margins erose .... **13. C. stricta**

11. Lip strongly eyed or blotched with yellow 12
+ Lip not eyed or blotched with yellow 15

12. Scape hysteranthous; lacking peduncle sheaths .... **10. C. punctulata**
+ Scape proteranthous or synanthous; with peduncle sheaths 13

13. Inflorescence 6- to 8-flowered .... **8. C. nitida**
+ Inflorescence 2- to 4-flowered 14

14. Inflorescence pendent, 2- or 3-flowered; flowers fragrant .... **7. C. corymbosa**
+ Inflorescence erect, 3- or 4-flowered; flowers not fragrant .... **9a. C. occultata** var. **occultata**

15. Lip with 4 or 5, bright yellow, fimbriate keels .... **11. C. cristata**
+ Lip with 3 simple keels, keels not yellow or fimbriate 16

16. Dorsal sepal less than 3cm long; flowering February to May .... **6. C. flaccida**
+ Dorsal sepal more than 3cm long; flowering October to January 17

17. Lip less than 3cm long; floral bracts persistent .... **4. C. assamica**
+ Lip more than 3cm long; floral bracts caducous .... **5. C. fuscescens** var. **fuscescens**

Section **Fuliginosae** Lindl. ex Pfitzer & Kränzlin in Engler, Pflanzenr. (IV.50) Coelog.: 33 (1907).

Pelser, Gravendeel & de Vogel (in Gravendeel, 2000) have studied the molecular phylogeny of *Coelogyne*. This work has resulted in a revision of section *Fuliginosae* where *C. fuliginosa* and *C. ovalis* have been sunk within *C. fimbriata*. We note this position but retain them as species here.

1. C. fimbriata Lindl. in Bot. Reg. 11: t.868 (1825). Type: China, *Parks* s.n. (holo. K-LINDL!, iso. P).
Pleione chinensis Kuntze, Revis. Gen. Pl. 2: 680 (1891), nom.alt.
P. fimbriata (Lindl.) Kuntze, *loc. cit.* (1891).
Coelogyne ovalis sensu Pfitzer & Kränzlin, Pflanzenr. (IV.50) Coelog.: 53, t.17d,e (1907), non Lindl. (1838).

Plant epiphytic or lithophytic, 9–30cm tall; *rhizome* creeping, sheathed. *Pseudobulbs* ovoid to ellipsoid, 3–4cm apart on rhizome, 2.5–4 × c.1.2cm. *Leaves* 2, oblong-elliptic, acute, 5-veined, 7.5–9 × 1.2–1.4cm; petiole grooved, 0.5–1.5cm long. *Inflorescence* hysteranthous, 1- to few-flowered (opening in succession); peduncle slender, erect, sheathed at base, c.2.5cm long; sheaths overlapping; rachis zigzag, 2.5–6cm long; floral bracts caducous (not seen). *Flowers* 3–3.5cm across; sepals and petals pale yellow-green, lip whitish or pale yellow, marked with dark brown; pedicel and ovary slender, 1–1.4cm long. *Dorsal sepal* lanceolate, acute, 5-veined, c.2 × 0.8cm; *lateral sepals* oblique, lanceolate, acute, 5-veined, c.2 × 0.6cm. *Petals* filiform, 2–2.2 × 0.1–0.15cm. *Lip* 3-lobed, 2–2.5 × 1.2–1.7cm; lateral lobes oblong-elliptic, obtuse, margins fimbriate; mid-lobe orbicular, margins fimbriate, long-pubescent; disc 3-keeled from lip base, median keel becoming a brown line, lateral keels undulate, almost meeting near apex. Column slender, curved, expanded into a hood, apex crenate, c.1.8cm long. Fruit long-beaked, 2.3–2.5 × 1.3–1.5cm.

Bhutan: C – Tongsa (Tashiling, between Tongsa and Chamka) and Tashigang (near Gamri Chu, between Shali and Tashi Yangtsi) districts; **Darjeeling** (Mongpu); **Sikkim** (Chakung, Yoksam). On trees by streams, on rocks in ericaceous scrub; 640–2580m. Fl. June–November; Fr. May.

GENERAL DISTRIBUTION. India (Himalayas), Nepal, Myanmar, China, Cambodia and Laos.
ETYMOLOGY. From the Latin *fimbriatus* (fimbriate) in reference to the lip margin.

2. C. **fuliginosa** Loddiges ex Hook. in Bot. Mag. 75: t.4440 (1849). Type: India, *Loddiges collector* s.n. (holo. K-LINDL!).
Pleione fuliginosa (Loddiges ex Hook.) Hook. f. ex Kuntze, Revis. Gen. Pl. 2: 680 (1891).
P. triplicata (Rchb. f.) Kuntze, loc. cit. (1891).

Plant epiphytic or lithophytic; *rhizome* creeping, slender, branched, sheathed. *Pseudobulbs* narrowly cylindric, angular, bare at base, 2.5–3cm apart on rhizome, 4–6 × c.1.4cm. *Leaves* 2, lanceolate, acute, 9-veined, 12–15 × 2.5–3.3cm; petiole grooved, c.1.4cm long. *Inflorescence* hysteranthous, 2- or 3-flowered (opening in succession); peduncle distinct, sheathed at base, c.3.5cm long; sheaths overlapping; rachis slender, zigzag, c.3.5cm long; floral bracts caducous (not seen). *Flowers* 5–6cm across, light brown, tinged greenish, lip with deep red-brown margins; pedicel and ovary slender, 2–2.4cm long. *Dorsal sepal* lanceolate, acute, 7-veined, c.3 × 1cm; *lateral sepals* lanceolate, acute, 5-veined, c.2.5 × 0.5cm. *Petals* linear, 3–3.5cm long. *Lip* 3-lobed, c.3 × 2cm; lateral lobes erect, rounded, margins fimbriate; mid-lobe orbicular, apex obtuse, margins fimbriate, hirsute; disc 3-keeled, median keel short, indistinct, lateral keels from base to apex, undulate. Column slender, expanded slightly to form a winged hood, apex crenulate, c.1.8cm long.

Sikkim (reported by Clayton, pers. comm.). On trees and rocks in valleys; 900–1500m. Fl. December–January.

GENERAL DISTRIBUTION. NE India, Myanmar, Java and Sumatra.
ETYMOLOGY. From the Latin *fuliginosus* (dirty-brown, almost sooty-black) in reference to the flower colour.

3. C. **ovalis** Lindl. in Bot. Reg. 24: misc.91, no.171 (1838). Type: Nepal, Thoka, coll. *Wallich* Wall. Cat. 1957.1 (holo. K-LINDL!, iso. K-W!).
Coelogyne fimbriata sensu Lindl., Gen. Sp. Orchid. Pl: 41 (1830), *non* Lindl. (1825).
Broughtonia linearis Wall. ex Lindl., op. cit. 42 (1830), *pro syn.*
Coelogyne pilosissima Planchon, Hort. Donat.: 144 (1854). Type: Nepal, local collector (holo. ?MPU).
C. decora Wall. ex Voigt, Hort. Suburb. Calcutt.: 621 (1845), *nom. nud.*
C. xerophyta Handel-Mazzetti, Symb. Sin. 7: 1346 (1936). Type: China, Yunnan, *Handel-Mazzetti* 8457 (holo. WU, iso. LE!).

Plant epiphytic or lithophytic; *rhizomes* creeping, branching, sheathed. *Pseudobulbs* ovoid-fusiform to fusiform, smooth, 5–7cm apart on rhizome, becoming ridged with age, sheathed at base, 5–8 × c.1.5cm. *Leaves* 2, narrowly elliptic, acute to acuminate, petiolate, 9–17 × 2.5–4cm; petiole grooved, c.2cm long. *Inflorescence* hysteranthous, few-flowered (opening in succession); peduncle slender, enclosed at base by 3 scale-like sheaths, c.5cm long; rachis slender, c.7cm long; floral bracts caducous.

Flowers 3–4cm across, pale yellowish-green, lip marked brown, keels darker brown, column yellowish-green; pedicel and ovary slender, 1–1.3cm long. *Dorsal sepal* ovate-lanceolate, acute, c.2.7 × 1.3cm; *lateral sepals* lanceolate, acuminate, reflexed, c.3 × 0.7cm. *Petals* linear, acute, reflexed, c.2.7 × 0.1cm. *Lip* saccate at base, 3-lobed; lateral lobes oblong to triangular, erect, partly enclosing the column, lower part of margins ciliate; mid-lobe ovate, apex rounded, mucronate, margins ciliate; disc 3-keeled at base of lip with 2 keels extending to mid-lobe apex, undulate. *Column* curved, hooded at rounded apex, c.1.5 × 0.7cm (at apex). **Plate 14.**

Bhutan: S – Samchi (Chepuwa Khola, SE of Samchi) and Deothang (3km NE of Narfong (M.F.B.)) districts; **C** – Punakha (Tinlegang) and Tongsa (below Shemgang, 9km along Tongsa road) districts; **Darjeeling** (unlocalised *Cowan* specimen); **Sikkim** (unlocalised *Pantling* specimen). On branches of trees, on humus covered rocks in hill forest, ravine in subtropical forest; 800–1800m. Fl. (March, M.F.B.) April–July(–December).

GENERAL DISTRIBUTION. India (Himalayas), Myanmar and China (Yunnan).
ETYMOLOGY. From the Latin *ovalis* (oval, elliptic) in reference to the pseudobulbs.

Section **Fuscescentes** Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 33 (1907).

4. **C. assamica** Linden & Rchb. f., Berliner Allg. Gartenzeitung 25: 403 (1857). Type: India, Assam, *Linden* s.n. (holo. B†, Lectotype (selected here): [icon. in] Xenia Orchid. 2: t.134, f.7–9 (1874)!).
Coelogyne fuscescens Hook. f., Fl. Brit. India 5(2): 833 (1890), p.p.
C. fuscescens var. *assamica* (Linden & Rchb. f.) Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 43 (1907).
Cymbidium evrardii Guillaumin in Bull. Soc. Bot. France 77: 339 (1930). Type from Vietnam.
Coelogyne saigonensis Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 10(4): 435 (1938). Type from Vietnam.

Plant epiphytic; *rhizome* sturdy. *Pseudobulbs* fusiform, clustered, 6–7 × 1.5–2cm. *Leaves* 2, elliptic-lanceolate, acute, 3- to 5-veined, 16–25 × 3.5–6cm; petiole c.3cm long. *Inflorescence* arching, 6- to 8-flowered (opening together); peduncle enclosed by overlapping sheaths at base, 10–12cm long; rachis weakly zigzag, 19–25cm long; floral bracts caducous, lanceolate, subacute, 2.2–2.5 × 0.4–0.7cm. *Flowers* c.7cm across, pale yellow, lip darker yellow with intricate brown veins on lateral lobes, veins of mid-lobe orange-brown. *Dorsal sepal* oblong, acuminate to subacute, 5- to 9-veined, c.3.2 × 0.9cm; *lateral sepals* linear, acute, falcate, c.2.8 × 0.6cm. *Petals* narrowly linear, 3-veined, 2.5–3 × 0.2–0.25cm. *Lip* 3-lobed, obovate, recessed on each side, c.2.6 × 1.2cm; lateral lobes triangular; mid-lobe suborbicular, shortly clawed, acute to subacute, c.1.2 × 1.3cm; disc 3-keeled, median keel reduced. *Column* clavate, curved, c.2cm long.

Bhutan: (unlocalised *Foerstermann* specimen (Das & Jain, 1980)). In riverine forest; 700m. Fl. January.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand, Laos and Vietnam
ETYMOLOGY. From Assam, a region of NE India, where the type specimen was collected.

5. **C. fuscescens** Lindl., Gen. Sp. Orchid. Pl.: 41 (1830). Type: Nepal, Thoka, coll. *Wallich* Wall. Cat. 1962.1 (holo. K-LINDL!, iso. K-W!).

var. **fuscescens**

Plant epiphytic, 18–28cm tall; *rhizome* stout, creeping. *Pseudobulbs* cylindric-fusiform, erect, becoming curved and deeply grooved with age, 1–2.5cm apart on rhizome, 8–14.5 × 1–3.2cm. *Leaves* 2, oblanceolate to oblong-elliptic, acute, prominently 6-veined beneath, 15–25 × 5–10cm; petiole grooved, c.2cm long. *Inflorescence* proteranthous (rarely synanthous), erect to suberect, 2- to 10-flowered (opening together); peduncle erect, sheathed at base, 8–9cm long; sheaths 4 or 5, overlapping, lanceolate, obtuse, 2–3cm long; rachis zigzag, 8–13cm long; floral bracts caducous (not seen). *Flowers* c.6cm across; sepals and petals pale yellow, flushed with brown towards apex, lip whitish with a pale yellow-green central stripe, marked with brown, keels vermilion, lateral lobes with a brown submarginal band; pedicel and ovary slender, 1–1.4cm long. *Dorsal sepal* oblong-lanceolate, acute, 3.5–4 × 1.25–1.5cm; *lateral sepals* oblong-lanceolate, acute, 3–4 × c.0.9cm. *Petals* linear, acute, 2.7–3.5 × 0.2–0.3cm. *Lip* 3-lobed, narrowly elliptic-oblong, acute, 3–4 × 1–1.5cm; lateral lobes short, narrowly oblong, rounded, reflexed; mid-lobe broadly ovate-elliptic to cordate, membranous, margins entire, undulate; disc fleshy, 3-keeled from base of lip to base of mid-lobe then becoming veined to apex. *Column* curved, winged, apex mucronate, c.2cm long. *Fruit* ellipsoid, ridged, c.4 × 1.5cm. **Plate 13.**

Bhutan: S – Samchi (Dorkha (M.F.B.)), Chukka (Marichong), Sarbhang (above Noonpani, 16km along Sarbhang–Chirang road) and Gaylegphug (Betini (M.F.B.), N of Rani Camp (M.F.B.)) districts; C – ?Tongsa district (Manas Camp (M.F.B.)); **Darjeeling** (Damsong Hills, Kurseong, Pedong); **Sikkim** (Kaluk). On mossy branches in damp, shady hill forest and lower montane forest; 750–2000m. Fl. October–December.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and NE Thailand.

ETYMOLOGY. From the Latin *fuscus* (brown) and the suffix *-escens* (becoming) in reference to the flowers.

Section **Flaccidae** Lindl., Fol. Orchid (Coelogyne) 5: 2 (1854).

(syn. *Carinatae* Pfitzer)

6. C. **flaccida** Lindl., Gen. Sp. Orchid. Pl.: 39 (1830). Type: Nepal, Naokote, coll. *Wallich* Wall. Cat. 1961 (holo. K-LINDL!, iso. E! K-W! K!).

Coelogyne lactea Rchb. f. in Gard. Chron. n.s. 23: 692 (1885). Tye: Myanmar (Burma), cult. Day (holo. W! Herb. no. 42299).

C. huettneriana sensu Hook. f., Fl. Brit. India 5(2): 830 (1890), *non* Rchb. f.

C. esquirolei Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 60 (1919).Type: China, Rochers, Esquirol 3418 (holo. B).

Plant epiphytic or lithophytic, 14–30cm tall; *rhizome* stout, sheathed. *Pseudobulbs* conical to ovoid-cylindric, grooved, clustered, sheathed at base, 3.5–12 × 1.3–4cm. *Leaves* 2, oblong-elliptic, acute to acuminate, prominently 3-veined, 5–20 × 1–5cm; petiole grooved, 2.5–4cm. *Inflorescence* heteranthous, pendent, 5- to 12-flowered (opening together); peduncle sheathed at base, c.7cm long; rachis weakly zigzag, c.20cm long; floral bracts caducous (not seen). *Flowers* 3–5cm across, creamy-white, centre of lip yellow, lateral lobe veins marked reddish-brown, mid-lobe spotted red at base, keels white, red-brown near apex; pedicel and ovary slender, straight, 2.3–2.6cm long. *Sepals* similar, lanceolate, acute, 1.5–2.6 × 0.3–0.4cm. *Petals* linear, acute, reflexed, 1.5–2.3 × 0.1–0.2cm. *Lip* 3-lobed, 1–1.3 × 0.6–0.8cm; lateral lobes oblong, erect, rounded; mid-lobe ovate-lanceolate, acute, reflexed; disc 3-keeled from lip base to base of mid-lobe, undulate-flexuose. *Column* straight, expanded into a winged hood, apex obscurely 2-lobed, c.1.5cm long. *Fruit* ovoid to obovoid, 3–4 × 1.5–1.9cm. **Plate 13.**

Bhutan: S – Sarbhang (near Noonpani, 13km along Sarbhang–Chirang road) and Gaylegphug (Rang Khola 4km NE of Surelakha) districts; **Darjeeling** (N of Peshok, Sureil, Tista River); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). By streams, on trees and rocks in open spaces in lower and upper montane forest; 330–2300m. Fl. February–May.

GENERAL DISTRIBUTION. India, Myanmar and China.

ETYMOLOGY. From the Latin *flaccidus* (flaccid), presumably a reference to the pendent inflorescence.

Section **Ocellatae** Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 56 (1907).

7. C. **corymbosa** Lindl., Fol. Orchid. Coelogyne 5: 7, no.16 (1854). Type: India, Khasia, *Hooker* 136 (holo. K-LINDL!).

Pleione corymbosa (Lindl.) Kuntze, Revis. Gen. Pl. 2: 680 (1891).

Coelogyne taronensis Handel-Mazzetti in Anz. Akad. Wiss. Wien. Math.-Naturwiss. Kl. 59: 254 (1922).
Type: China, Yunnan, *Handel-Mazzetti* 9163 (holo. WU).

Plant epiphytic or lithophytic, 12–24cm tall; *rhizome* stout. *Pseudobulbs* clustered, ovoid to weakly rhomboid, developing serially, sheathed at base, 2.5–4 × 1.8–2cm; sheaths dark brown. *Leaves* 2, erect, elliptic-lanceolate, acute, coriaceous, 5-veined, 10–20 × 2–3.5cm; petiole grooved, 5–8mm long. *Inflorescence* synanthous or proteranthous, erect to pendent, 2- to 4-flowered (opening together); peduncle covered by overlapping sheaths, 8–15cm long; rachis slender, 2–3cm long; floral bracts oblong-lanceolate, acute, caducous, 2–2.5 × 0.3–0.4cm. *Flowers* fragrant, fleshy, 4–7cm across, white with 4 large yellow eyes bordered with orange-red on lip; pedicel and ovary c.3cm long. *Sepals* similar, lanceolate, acute, 1-veined, 2.5–3.8 × 0.7–0.9cm. *Petals* narrowly lanceolate, acute, 1-veined, 2.5–3.3 × 0.4–0.8cm. *Lip* 3-lobed, 1.5–2 × 0.7–1.1cm; lateral lobes rounded; mid-lobe ovate to ovate-lanceolate, acute to acuminate; disc 3-keeled from lip base to base of mid-lobe, keels low, crenulate. Column curved, broadly winged, apex 3-lobed, c.1.8cm long. **Plate 13.**

Bhutan: S – Phuntsholing (above Kamji), Chukka (Gedu, 5km N of Jumudag), Sarbhang (between Tori Bari and Loring Falls), Gaylegphug (Gale Chu Valley) and Deothang (Narfong (M.F.B.)) districts; C – Thimphu (between Barshong and Dotena, Thimphu Chu), Punakha (2km above Manchunang, between Samtengang and Ritang), Tongsa (Dorji Gompa, Ritang, Rukubji, Tashiling), Tongsa/Bumthang (Yuto La) and Bumthang/Mongar (Rudong La) districts; **N** – Upper Mo Chu district (Gasa, near Tamji); **Darjeeling** (Bhotia Basti to Budhwari, Bloomfield, Parmaguri, between Tonglu and Manibhanjan); **Sikkim** (between Samanden and Raman, SW of Sukiapokhri and Jorepokhri). In dense evergreen oak/laurel forest, on *Quercus griffithii* and *Rhododendron arboreum*, rocky roadside in steep warm broad-leaved forest, on cliff faces; 1360–3800m. Fl. February–June.

GENERAL DISTRIBUTION. Nepal, NE India and China.

ETYMOLOGY. From the Latin *corymbosus* (a flat-topped raceme) in reference to the inflorescence.

8. C. **nitida** (Wall. ex D. Don) Lindl., Gen. Sp. Orchid. Pl.: 40 (1830). Type: Nepal, coll. *Wallich* Wall. Cat. 1954 (holo. K-LINDL!, iso. C! K-W! K!).

Cymbidium nitidum Wall. ex D. Don, Prodr. Fl. Nepal.: 35 (1825).

Coelogyne ochracea Lindl. in Bot. Reg. 32: t.69 (1846). Types: Bhutan, *Griffith* 25 (syn. K-LINDL!); India, Mishmee Hills, *Griffith* 19 (syn. K-LINDL!).

Plant epiphytic or lithophytic, 18–26cm tall; *rhizome* stout. *Pseudobulbs* ovoid to conical, furrowed, erect, 2–2.5cm apart on rhizome, 3–7.5 × 1–2cm. *Leaves* 1 or 2 from pseudobulb apex, narrowly elliptic-lanceolate, acute, 8-veined, 15–25 × 2.5–3cm; petiole grooved, 4–4.5cm long. *Inflorescence* proteranthous, erect or pendent, 3- to 7-flowered (opening together); peduncle bare or sheathed at base, 14–16cm long; sheaths broadly lanceolate, acute, overlapping, 2–3cm long; rachis weakly zigzag, 6–8cm long; floral bracts caducous (not seen). *Flowers* c.4cm across; sepals and petals white, lip white with 4 yellow eye marks on the lateral lobes, disc yellow bordered with red; pedicel and ovary 1–2cm long. *Sepals* similar, narrowly oblong, subacute to obtuse, 2–3.5 × 0.6–0.7cm. *Petals* narrowly oblong-lanceolate, subacute, 2–2.5 × 0.2–0.5cm. Lip 3-lobed, ovate, 1.5–1.9 × 1–1.6cm; lateral lobes oblong to rounded; mid-lobe orbicular-cordate, apex rounded to subacute; disc 3-keeled from lip base. Column slender, weakly curved, hooded at apex, margins entire to weakly erose, c.1.2cm long. Fruit ellipsoid, 3.5–4 × 0.9–1.4cm.

Bhutan: S – Samchi (Sangura (M.F.B.)), Sarbhang (Dhopi, near Chirang), Gaylegphug (Gaylegphug, 2km above Rani Camp, N of Gaylegphug) and Deothang (between Deothang and Narfong (M.F.B.)) districts; C – Tongsa/Bumthang district (Yuto La (F.E.H.2)); **N** – Upper Mo Chu district (near

Tamji (F.E.H.2)); **Darjeeling** (between Bhotia Basti and Budhwari, Kurseong, Mahaldiram, Nora Villa); **Sikkim** (Mamring, Rathang Chhu, between Rora Chu and Gangtok, near Rumtek, Yoksam). On rocks at roadside in moist forest, on *Alnus nepalensis* and other mossy trees; 1500–2950m. Fl. (December–)April–June.

GENERAL DISTRIBUTION. N India (Himalayas), Nepal, Myanmar and China (Yunnan).
ETYMOLOGY. From the Latin *nitidus* (glossy) in reference to the flowers.

9. C. **occultata** Hook. f., Fl. Brit. India 5(2): 832 (1890); Icon. Pl. 22: t.2104 (1894). Type: India, Sikkim Himalaya, *Griffith* 5159 (holo. K!).

9a. var. **occultata**

Plant epiphytic or lithophytic, 9–12cm tall; *rhizome* creeping. *Pseudobulbs* ovoid, apex turbinate, acute, ridged, glossy green, 2.5–4 × 0.7–1.4cm. *Leaves* 2, narrowly elliptic to elliptic, acute, 3- to 5-veined, 2.5–8 × 0.9–2.2cm; petiole grooved, 0.8–1cm long. *Inflorescence* hysteranthous, erect, 3- or 4-flowered; peduncle slender, enclosed by overlapping sheaths, c.4cm long; sheaths lanceolate, acute, 1–1.5cm long; rachis c.5mm long; floral bracts not seen. *Flowers* c. 2.5cm across; sepals and petals white, lip white, lateral lobes streaked with dull red-brown, mid-lobe with yellow eyes, column white with orange-yellow band at base; pedicel and ovary c.5mm long. *Sepals* similar, spreading, oblanceolate, acute, c.2.2 × 0.6cm. *Petals* narrow, linear-oblong, acute, c.2 × 0.4cm. *Lip* 3-lobed, c.1.5cm long; lateral lobes large, erect, rounded, margins crenulate; mid-lobe ovate, obtuse, margins crenulate; disc 3-keeled from base to mid-lobe, median keel short, lateral keels thick, crenate. *Column* slender, hooded, broadly winged c.1.4cm long. Fruit ellipsoid, c.3.5 × 1cm.

Bhutan: S – Deothang district (near Narfong (M.F.B.), near Wamrong); **C** – Punakha (Lamperi, between Samtengang and Ritang), Tongsa (Changkha, between Longtepang and Ritang, Tashiling (F.E.H.2)) and Tashigang (near Yongpu La) districts; **N** – Upper Bumthang Chu district (near Chamka); **Darjeeling** (10km S of Darjeeling); **Sikkim** (Lachen Valley, Tendong). In dense *Cryptomeria japonica* plantation, in moss on rocks and on *Lithocarpus* sp.; 1800–3850m. Fl. March–July.

GENERAL DISTRIBUTION. NE India and Myanmar.
ETYMOLOGY. From the Latin *occultatus* (hidden) in reference to the sheaths that cover, and almost hide, the peduncle.

9b. var. **uniflora** N.P. Balakrishnan in J. Bombay Nat. Hist. Soc. 75(1): 159, f.3 (1978). Type: E Bhutan, Nyoth forest, *Balakrishnan* 43041 (holo. CAL, iso. ASSAM).

Plant epiphytic or lithophytic; *rhizome* creeping. *Pseudobulbs* narrowly obovoid, clavate, acute, weakly grooved, 1–2cm apart on rhizome, 3–4cm tall. *Leaves* 2, elliptic, acute, 3- to 5-veined, 5–7.5 × 1.5–2.3cm; petiole grooved, 1–1.8cm long. *Inflorescence* synanthous or hysteranthous, erect, 1- or 2-flowered (opening together); peduncle sheathed, slender, c.4cm long; rachis obscure; floral bracts persistent. *Flowers* c.2.5cm across; sepals, petals and lip white, lip with reddish-brown veins, a dark yellow spot bordered with reddish-brown on lateral lobes and 2 on mid-lobe, column white with orange-yellow band in front at base. *Sepals* similar, spreading, elliptic-oblong, subacute, c.2.2 × 0.6cm. *Petals* linear-lanceolate, subacute, c.2 × 0.4cm. *Lip* 3-lobed; lateral lobes large, erect, rounded, margins crenulate; mid-lobe ovate, acute, reflexed; disc 2-keeled, from lip base and terminating at mid-lobe spots. *Column* slender, hooded, winged, c.1.4cm long.

Bhutan: C – Tashigang district (Nyoth near Tashi Yangsi (Balakrishnan, 1978)). On moss-covered trees and rocks in upper montane forest; 1830–3500m. Fl. April–July.

GENERAL DISTRIBUTION. NE India and Myanmar.
ETYMOLOGY. From the Latin *uni-* (one) and *flos* (flower).

10. C. punctulata Lindl., Coll. Bot.: sub t.33 (1821). Type: Nepal, *Wallich* s.n. (holo. BM!, iso. C WU).

Cymbidium nitidum sensu Roxb., Hort. Bengal: 63 (1814), nom nud.; Fl. Ind. ed. 1832(3): 459 (1832), non Wall. ex D. Don.

Coelogyne ocellata Lindl., Gen. Sp. Orchid. Pl.: 40 (1830). Type: Bangladesh, Sylhet, coll. *F. De Silva* Wall. Cat. 1953.1 (syn. K-LINDL!, isosyn. K-W!); India, Sermore (Sirmaur), Kamroop, Wall. Cat. 1953.2 (syn. K-LINDL!, isosyn. K-W!).

C. goweri Rchb. f. in Gard. Chron. 1869: 443 (1869). Type: India, Assam, cult. Williams (holo. W).

C. ocellata var. *maxima* Rchb. f., *op. cit.* n.s.11: 524 (1879) Type without provenance.

C. ocellata var. *boddaertiana* Rchb. f., *op. cit.* n.s. 18: 776 (1882). Type without provenance.

C. nitida sensu (Roxb.) Hook. f., Fl. Brit. India 5(2): 837 (1890), non (Wall. ex D. Don) Lindl.

Pleione goweri (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 680 (1891).

P. nitida (Roxb.) Kuntze, *loc. cit.* (1891).

Coelogyne punctulata var. *hysterantha* T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 78 (1951). Type: China, Yunnan, *Forrest* 26146 (holo. K!).

Plant epiphytic, 14–35cm tall. *Pseudobulbs* subpyriform, angular, covered by persistent sheaths, 3.8–7.6cm tall. *Leaves* 2, narrowly lanceolate, acute, 5- to 7-veined, 18–25.5 × 2.5–3cm; petiole grooved 1.5–2cm. *Inflorescence* hysteranthous, erect, c.5-flowered; peduncle sheathless, 7.5–9.5cm long; rachis weakly zigzag, 3–4cm long; floral bracts lanceolate, acute, reddish-brown, caducous, 2.5–3 × 0.5–0.7cm. *Flowers* c.2.5cm across; sepals, petals and lip pure white, lip with 2 bright orange-yellow spots on each lateral lobe and at base of mid-lobe, column bordered with bright orange-yellow; pedicel and ovary 2–2.5cm long. *Sepals* similar, oblong-lanceolate, acute, 2.9–3.4 × 0.6–0.9cm. *Petals* linear-oblong, obtuse, 2.5–2.7 × 0.4–0.5cm. Lip 3-lobed, 2.5–3. × 1.4–1.5cm; lateral lobes truncate; mid-lobe ovate; disc 3-keeled, dentate, converging towards mid-lobe base, becoming 2 divergent lateral keels on mid-lobe. *Column* long, curved, clavate and winged at apex, 1.5–1.8cm long. *Fruit* ovoid, c.4 × 1.2cm.

Sikkim (Rangit Chhu). On trees in upper montane forest; 200–2200m. Fl. March–April.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and China (Yunnan).

ETYMOLOGY. From the Latin *punctulatus* (spotted) in reference to the lip pattern.

Section Cristatae Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 56 (1907).

11. C. cristata Lindl., Coll. Bot.: sub t.33 (1821). Type: Nepal, Toka, coll. *Wallich* Wall. Cat. 1958.1 (holo. K-LINDL!, iso. K-W! K!).

Cymbidium speciosissimum D. Don, Prodr. Fl. Nepal.: 35 (1825). Type: Nepal, *Wallich* s.n. (holo. BM!).

Plant epiphytic (occasionally lithophytic), 13–30cm tall; *rhizome* stout, sheathed, pseudobulbs spaced 5–6cm apart. *Pseudobulbs* cylindric-ovoid, smooth, 5–7.5 × 2–4cm. *Leaves* 2, linear-lanceolate, acute, margins slightly undulate, sessile, 15–30 × 2–2.7cm. *Inflorescence* heteranthous, pendent, 3- to 10-flowered (opening together); peduncle sheathed, 8–9cm long; sheaths overlapping, lanceolate, acute, 1.5–5 × 0.8–1.4cm; rachis c.8cm long; floral bracts oblong-lanceolate, acute, persistent, 1.8–5.5cm long. *Flowers* 5–9cm across; sepals and petals white, lip white with yellow keels (between the lateral lobes) and crenulate plates (on the mid-lobe), column white; pedicel and ovary widening at base of flower, 5–6cm long. *Sepals* similar, narrowly elliptic-oblong, subacute, undulate, 3.7–5 × 1–1.7cm. *Petals* narrowly elliptic-oblong, acute, undulate, 3.5–4.5 × 0.5–1.7cm. Lip 3-lobed, 3.5–4 × 3–3.5cm; lateral lobes large, rounded; mid-lobe suborbicular; disc with 4 or 5 fimbriate keels from lip base to apex. *Column* curved, broadly winged, 2.6–3.2cm long. *Fruit* c.4 × 2cm. **Plate 13.**

Bhutan: C – Punakha district (Chachuphu, between Wache and Ngawang, Wangdi Phodrang to Samtengang); **Darjeeling** (Birch Hill, Dumsong, Happy Valley, near Lopchu above Peshok, near Parmaguri); **Sikkim** (Lusing, Namthang, Phusum). On large trees and rocks in shaded and upper montane forest, warm broad-leaved forest, on N-facing slope of valley; 1330–2600m. Fl. February–July.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Latin *cristatus* (crested) in reference to the keels on the lip.

Section **Elatae** Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 78 (1907).

12. C. **barbata** Lindl. ex Griff., Itin. Pl. Khasyah Mts.: 72 (1848); Not. Pl. Asiat. 3: 280 (1851). Type: NE India, Khasia, *Griffith* s.n. (holo. K-LINDL!).

Plant epiphytic or lithophytic; *rhizome* stout. *Pseudobulbs* clustered, ovoid to subglobose or pyriform, angular, pale green, enclosed within sheaths at base, 7.5–10 × c.2.5cm. *Leaves* 2, oblong-lanceolate, acuminate, margins undulate, coriaceous, c.45 × 5cm; petiole c.14cm long. *Inflorescence* hysteranthous, erect to arching, 4- to 12-flowered (opening in succession); peduncle sheathed between peduncle and rachis; sheaths distichous, overlapping, glume-like, ovate-lanceolate, 0.5–1.5cm long; rachis slender, zigzag, c.18cm long; floral bracts caducous. *Flowers* musk-scented, 5–8cm across; sepals and petals pure white, lip fringed with sepia-brown projections, column white; pedicel and ovary slender, 1.5–2cm long. *Dorsal sepal* ovate-oblong, acute, margins reflexed, 11-veined, 3.7–4 × 1.5–1.6cm; *lateral sepals* similar, apices acute to acuminate. *Petals* linear-lanceolate, acute, apex reflexed, 3-veined, c.3.8 × 0.55cm. Lip 3-lobed; lateral lobes short, ovate, erect, margin fimbriate; mid-lobe triangular, margins with dense fimbriate projections of c.6mm long; disc 3-keeled, fimbriate. *Column* slightly curved, expanded into a winged hood, margins erose, apex 2-mucronate, c.2.5cm long. **Fig.** 79; **Plate** 12.

Bhutan: S – Chukka (Chukka, between Jumudag and Tala) and Gaylegphug (Gaylegphug) districts; C – Tongsa (near Shemgang) and Tashigang (Nyoth (M.F.B.)) districts; **Darjeeling** (Kalimpong (Ghose, 1964)); Sikkim (near Phadamchen (Lucksom, 1993)). On rocks and trees, on *Quercus lamellosa* and *Castanopsis tribuloides*, in lower montane forest, in warm broad-leaved forest; 1000–2080m. Fl. August–February.

GENERAL DISTRIBUTION. N India and Myanmar.
ETYMOLOGY. From the Latin *barbatus* (with tufts of hair) in reference to the projections on the lip margins.

13. C. **stricta** (D. Don) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 184 (1919). Type: Nepal, without precise locality, *Wallich* s.n. (holo. BM!).
Cymbidium strictum D. Don, Prodr. Fl. Nepal.: 35 (1825).
Coelogyne elata Lindl., Gen. Sp. Orchid. Pl.: 40 (1830). Type: Nepal, coll. *Wallich* Wall. Cat. 1959 (holo. K-LINDL!, iso. E! K-W! K!).

Plant epiphytic, 30–40cm tall; *rhizome* stout, sheathed. *Pseudobulbs* cylindric, covered by sheaths at base, c.5cm apart on rhizome, glossy green, 7.5–15 × 2.5–6.5cm. *Leaves* 2, elliptic-oblong, acute, coriaceous, narrowed to base, 22–35 × 5–7cm; petiole 3–7.5cm long. *Inflorescence* hysteranthous, 10- to 15-flowered (opening together); peduncle erect, with large, overlapping, glume-like sheaths between peduncle and rachis, c.26cm long; rachis stiff, c.15cm long; floral bracts caducous (not seen). *Flowers* c.3cm across, white, with a yellow-orange patch near base of mid-lobe, keels orange; pedicel and ovary 1–1.5cm long. *Sepals* similar, oblong, subacute, spreading, 1.5–2.4 × 0.4–1cm. *Petals* narrowly oblong, acute, 1.5–2.4 × 0.4–1cm. Lip 3-lobed, 1.4–2.3 × 1–1.2cm; lateral lobes erect, narrow, entire; mid-lobe suborbicular to cordate, margins erose; disc 2-keeled from lip base to centre of mid-lobe, crenulate or fimbriate. Column straight, dilated towards apex, c.8mm long. **Plate** 14.

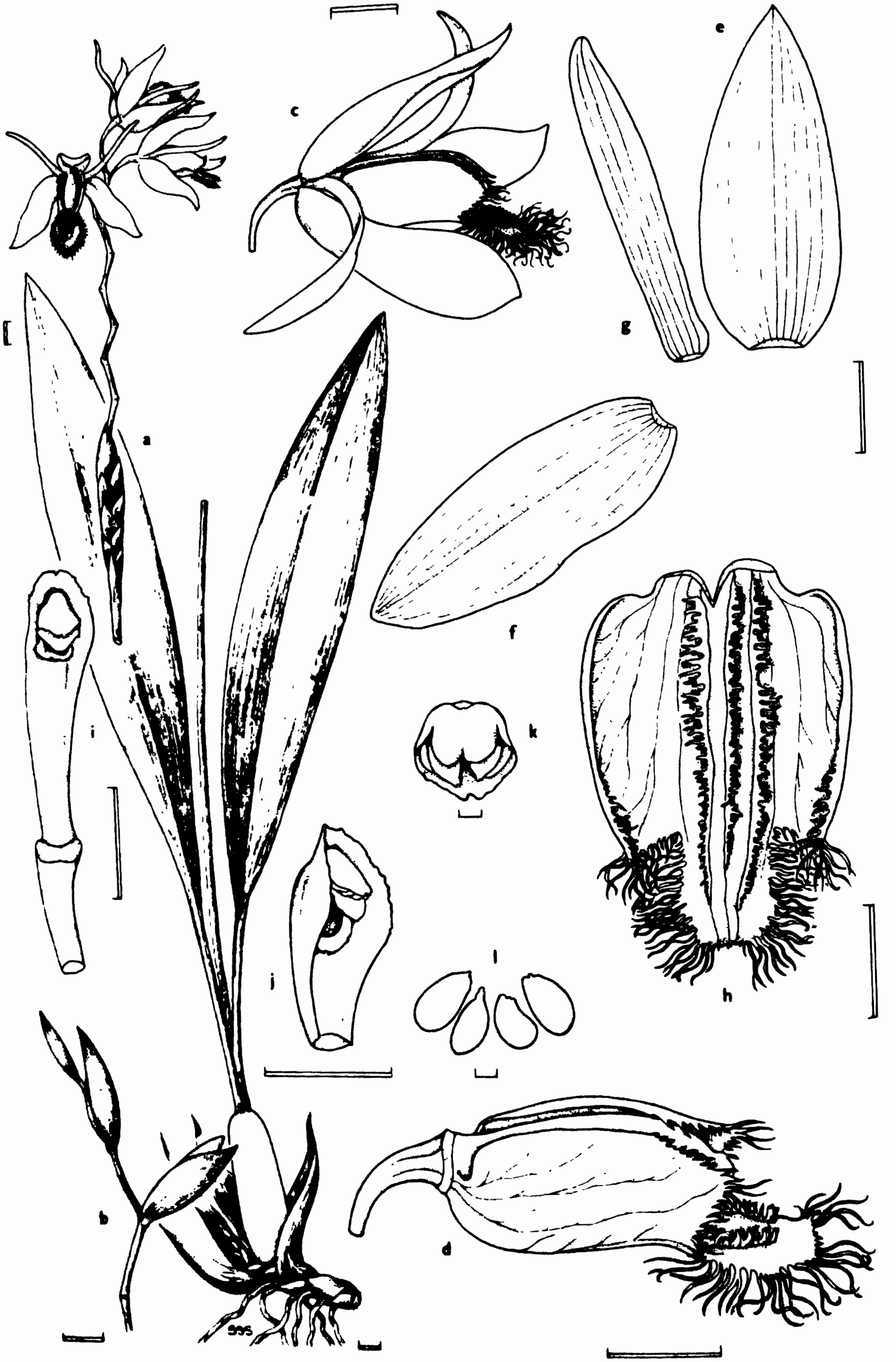


Fig. 79 **Coelogyne barbata**: a, habit (with detached inflorescence); b, inflorescence; c, flower; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal, g, petal; h, lip; i, column; j, column apex; k, anther; l, pollinia. Drawn by Susanna Stuart-Smith, a from *Hooker* s n. (K); b from *Kingdon-Ward* 7423 (K); c–l from *Grierson & Long* 3255 (K).

Bhutan: S – Chukka (Raidak Valley) and Gaylegphug (Gale Chu vallley, Rang Khola 4km NE of Surelakha) districts; C – Thimphu (between Dotena and Thimphu), Punakha (between Bhotokha and Rimchu, Khosa, between Wache and Ngawang) and Tongsa (Shemgang Dzong, ridge S of Shemgang) districts; N – Upper Mo Chu district (Mishichen to Tamji); **Darjeeling** (Tonglu); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). On broad-leaved trees, in *Quercus griffithii* and *Rhododendron arboreum* forest, on steep river banks in lower and upper montane forest; 980–3300m. Fl. March–June; October–November.

GENERAL DISTRIBUTION. Nepal, NE India and Myanmar.

ETYMOLOGY. From the Latin *strictus* (upright and straight) in reference to the inflorescence.

Section **Proliferae** (Lindl.) Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 82 (1907).

14. C. **longipes** Lindl., Fol. Orchid. Coelogyne 5: 10, no.25 (1854). Type: India, Khasia, *Hooker & Thomson* 129 (holo. K-LINDL!, iso. BM!).

Plant epiphytic, 24–30cm tall; *rhizome* slender, sheathed, 4–5mm thick; *roots* long-filiform. *Pseudobulbs* slender, cylindric to narrowly ovoid, 4–5cm apart on rhizome, 3.5–10 × 0.5–1.8cm. *Leaves* 2, lanceolate, acuminate, 5- to 7-veined, 6–18 × 1.5–5cm; petiole grooved, 1.5–5cm long. *Inflorescence* hysteranthous, 3- to 5-flowered (opening in succession); peduncle slender, 7–15cm long; sheaths at junction of peduncle and rachis overlapping, glume-like, 2–3mm long (growth extension annual, with further sheaths inserted between old and new growth); rachis weakly zigzag, 3–9cm long; floral bracts caducous (not seen). *Flowers* 1–2cm across, uniformly yellow; pedicel and ovary slender, 5–7mm long. *Sepals* subsimilar, ovate-oblong, acute to acuminate, 1.2–2 × 0.4–0.6cm. *Petals* filiform, straight, c.1cm long. *Lip* 3-lobed, contracted and saccate at base, c.1cm long; lateral lobes erect, triangular, rounded; mid-lobe cordate, mucronate, margins erose and weakly undulate; disc 2-keeled, prominent on mid-lobe only. *Column* slender, curved, apex broadly winged, c.1.1cm long. *Fruit* ellipsoid, long beaked, c.2.5 × 0.6cm.

Bhutan: S – Gaylegphug (Rani Camp (M.F.B.)) and Deothang (Narfong (M.F.B.)) districts; C – Tashigang district (Gamri Chu); **Sikkim** (Lachen Valley). On mossy branches in upper montane forest; 1350–2300m. Fl. May–June (throughout year).

GENERAL DISTRIBUTION. NE India, Myanmar, SW China, Thailand and Laos.

ETYMOLOGY. From the Latin *longius* (long) and *pes* (foot, in the sense of 'at the base of') in reference to the long, cylindric pseudobulbs.

15. C. **prolifera** Lindl., Gen. Sp. Orchid. Pl.: 40 (1830). Type: Nepal, Noakote (Nawakot), coll. *Wallich* Wall. Cat. 1956 (holo. K-LINDL!, iso. BM! K-W! K! OXF! W!).

Coelogyne flavida Wall. ex Lindl., Fol. Orchid. Coelogyne 5: 10, no.24 (1854). Types: India, Khasia, *Lobb* s.n. (syn. K-LINDL!, isosyn. K!); Sikkim, icon. Cathcart (syn. K!).

Plant epiphytic, 12–30cm tall; *rhizome* stout, creeping, sheathed; rhizome sheaths overlapping, ovate-lanceolate, acute, 1–2.5 × 0.6–1cm. *Pseudobulbs* ovoid-cylindric, compressed, sheathed at base, 3–5cm apart on rhizome, 2.5–6 × c.1.5cm. *Leaves* 2, narrowly lanceolate, acuminate, 7-veined, 6–18 × 1.5–2cm; petiole grooved, 3–4cm long. *Inflorescence* hysteranthous, erect, 3- to 10-flowered (opening together); peduncle slender, 10–15cm long; sheaths at junction of peduncle and rachis overlapping, glume-like, 2–7mm long (growth extension annual with further sheaths inserted between old and new growth); rachis slender, zigzag, 3.5–6cm long; floral bracts caducous (not seen). *Flowers* 1–1.5cm across; sepals and petals greenish-yellow, lip lateral lobes brown-veined, mid-lobe yellow, column yellow; pedicel and ovary slender, 0.9–1.2cm long. *Sepals* subsimilar, triangular to oblong, obtuse, 1-veined, 8–9 × 2.5–3mm. *Petals* linear, acute, reflexed, 6–7 × c.5mm long. *Lip* 3-lobed, c.5mm long:

lateral lobes erect, enclosing the column, small, obtuse; mid-lobe wedge-shaped to obcordate at base expanded to an orbicular-quadrate, rounded-retuse apex, margins undulate-dentate; disc 2-keeled from lip base to mid-lobe base. *Column* straight, winged, apex 2-lobed, c.5mm long. *Fruit* ovoid, 1.3–1.5 × 0.5–0.6cm.

Bhutan: S – Phuntsholing (below Sorchen), Chukka (Raidak Valley) and Deothang (Narfong (M.F.B.)) districts; C – Tashigang district (Gamri Chu); **Darjeeling** (Tista Valley); **Sikkim** (between Rathang Chhu and Thinglen). On tree trunks and lower branches, lower and upper montane forest; 660–2300m. Fl. March–July.

GENERAL DISTRIBUTION. Nepal, NE and S India, Myanmar and China.
ETYMOLOGY. From the Latin *prolifer* (proliferous) in reference to the bracts at the junction of the peduncle and rachis.

16. C. **raizadae** S.K. Jain & S. Das in Proc. Indian Acad. Sci., B. 87(5): 119 (1978). Type: India, Khasia Hills, Mawsmai, *Das* 55419 (holo. CAL, iso. ASSAM).
Coelogyne longipes sensu Hook. f., Fl. Brit. India 5(2): 839 (1890), non Lindl.

Plant epiphytic or lithophytic, 20–30cm tall; *rhizome* ascending. *Pseudobulbs* cylindric, tapering above, slightly ridged when old, sheathed, 2–8cm apart on rhizome, 3–9.5 × 0.6–1.2cm. *Leaves* 2, narrowly elliptic-oblong, acute to acuminate, entire, 5–7 veined, 6–11 × 1.6–2.5cm; petiole grooved, 1.3–5cm long. *Inflorescence* hysteranthous, erect, 2- to 6-flowered; peduncle slender, 3–15cm long; sheaths at junction of peduncle and rachis overlapping, glume-like, c.5mm long (growth extension annual with further sheaths inserted between old and new growth); rachis weakly zigzag, 4–4.5cm long; floral bracts caducous (not seen). *Flowers* 1–1.2cm across; sepals, petals and lip white to creamy, lip sometimes tinged with yellow or light brown, keels yellow; pedicel and ovary 0.5–1cm long. *Sepals* subsimilar oblong-lanceolate, acute, 3- to 5-veined, 1.2–1.5 × 0.3–0.5cm. *Petals* filiform, reflexed, acute, entire, 1-veined, 0.7–1 × 0.4–0.5cm. Lip 3-lobed, 1.1–1.5 × 0.6–0.7cm; lateral lobes narrowly oblong, obtuse to subacute, clasping the column, 0.8–1.1 × 0.1–0.3cm; mid-lobe oblong-obcordate, retuse, margins undulate-crenulate, 3–4mm long; disc 3-keeled, median keel short, lateral keels parallel. *Column* weakly curved, narrowly winged at apex, 0.9–1.3cm long.

Bhutan: C – Tongsa (Changkha) and Tashigang (Dalingmang, near Tashi Yangtsi) districts; **Sikkim** (Rimbi Chhu, Sosing). Lower montane forest, E-facing slope with *Gaultheria* sp., *Rhododendron dalhousiae*, *R. arboreum* and *Pinus wallichiana*, on oak; 1830–2660m. Fl. March–June.

GENERAL DISTRIBUTION. Nepal, NE India, SW China to Laos.
ETYMOLOGY. Named after Professor M.B. Raizada, formerly Head of the Botany Division, Dehra Dun and a leading Indian plant taxonomist.
NOTE. Ormerod (1997) noted that this species was vegetatively indistinguishable from C. *longipes*. It differs in having white to yellow flowers, an oblong-elliptic lip and parallel disc keels.

17. C. **schultesii** S.K. Jain & S. Das in Proc. Indian Acad. Sci., B. 87(5): 121 (1978). Type: India, Khasia, Cherrapunjee, *Das* 60256 (holo. CAL, iso. ASSAM).
Coelogyne prolifera sensu Lindl., Fol. Orchid. Coelogyne 5: 10, no.23 (1854), non Lindl. (1830).
C. *longipes* var. *verruculata* S.C. Chen in Acta Phytotax. Sin. 21(3): 346 (1983). Type: China, Yunnan, Salwin Valley, T.T. Yü 19264 (holo. PE).
C. *flavida sensu* Seidenfaden in Dansk Bot. Ark. 29(4): f.37 (1975), non Hook. f. ex Lindl.

Plant epiphytic or lithophytic, 15–30cm tall; *rhizomes* stout, creeping, sheathed, 0.5–1cm thick. *Pseudobulbs* ovoid to ellipsoid, irregularly ridged and furrowed (rarely smooth), sheathed at base, green, 1–3.5cm apart on rhizome, 1.5–5 × 1.7–2cm. *Leaves* 2, oblong to elliptic-lanceolate, acute to acuminate, margins entire, 7-veined, 6.3–18.6 × 1–1.3cm; petiole grooved, 1–1.3cm long. *Inflorescence* hysteranthous, erect to curved, 4- to 9-flowered; peduncle green to greenish-brown, 5–25cm long; sheaths at junction of peduncle and rachis overlapping, glume-like, 2–6mm (growth extension annual with further sheaths inserted between old and new growth); rachis slender, weakly zigzag, 7–8cm long; floral bracts caducous (not seen). *Flowers* 1.5–3cm across; sepals and petals brownish-yellow or greenish to dark brown, lip brownish-yellow to dark brown, base creamy, column light yellow; pedicel and ovary slender, 5–8mm long. *Dorsal sepal* oblong-lanceolate, acute, entire, membranous, 5- to 7-veined, 1.2–1.8 × 0.6–0.9cm; *lateral sepals* subsimilar, spreading, 1.2–1.8 × 0.4–0.6cm. *Petals* spreading or reflexed, filiform, acuminate, entire, smooth, membranous, 1-veined, 1.2–1.8 × 0.1–0.2cm. *Lip* deeply 3-lobed, 1–1.8 × 0.4–0.6cm (when spread); lateral lobes oblong, obtuse, entire, tips enclosing column, 0.8–1.2 × 0.3–0.5cm; mid-lobe orbicular to subquadrate, reflexed, margins finely dentate-undulate, 0.7–1 × 0.8–1.1cm; disc 2-keeled, keels faint at base, high and prominent on mid-lobe. *Column* weakly curved, entire, broadly winged at apex, 3–5mm long. *Fruit* ellipsoid, long beaked, 1.5–1.9 × 0.5–0.6cm. **Plate 14.**

Bhutan: S – Sarbhang district (Dara Chu); C – Mongar (Thrumsing La) and Tashigang (Gamri Chu, 9km before Tashi Yangtsi) districts; **Sikkim** (Chunthang, Lachung Valley, Sosing). On *Rhododendron* sp., *Schima* sp. and *Quercus griffithii* and moss-covered rocks in lower montane forest; 1000–2000m. Fl. (January–)March–June.

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. Named after Professor Richard Schultes of Harvard University, an expert on orchids and economic botany.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

C. **fuscescens** var. **brunnea** (Lindl.) Lindl., Fol. Orchid. Coelogyne 5: 11, n.26b (1854) *nomen tantum*. Type: cult. Syon (holo. K-LINDL!).
Coelogyne brunnea Lindl. in Gard. Chron. 1848: 71 (1848).

NOTES. Lindley, when proposing this variety, included a Hooker collection from Sikkim. Rolfe (1913) and Seidenfaden (1975c), however, referred this collection to var. *fuscescens*. Var. *brunnea* is found in Myanmar and has not been confirmed from our area. Das & Jain (1980) reported it from Bhutan and Chowdhery (1998) from W Kameng in Arunachal Pradesh, but further collections are required before this can be confirmed.

C. **griffithii** Hook. f., Fl. Brit. India 5(2): 838 (1890); Icon. Pl. 22: t. 2108 (1894). Types: India, Assam, Patkoye Mountain, *Griffith* 5091 (syn. K!); Munnipore (Manipur), *Watt* 6780 (syn. K!).

NOTE. Reported by Rao & Deori (1980) from Parila-Sissini in the Kameng district of Arunachal Pradesh. We have seen no collections of this species from our area.

C. **holochila** P.F. Hunt & Summerhayes in Kew Bull. 20: 52 (1966). Type: Myanmar (Burma), Chin Hills, Mount Victoria, cult. Glasnevin B.G. (holo. K!).
Coelogyne elata sensu Hook. in Bot. Mag. 83: t.5001 (1857), *non* Lindl. (1830).

NOTES. Hunt & Summerhayes described this species because they had noticed that two illustrations of *C. elata* in Pfitzer & Kränzlin (1907) showed distinct species. W.J. Hooker had earlier illustrated a plant corresponding to Pfitzer & Kränzlin's illustration 30B as *C. elata*. This illustration (from an unlocalised specimen cultivated at Hornsey by Mr Parker) shows a plant with two large lateral crests and a smaller basal median crest which they considered to be distinct and called *C. holochila*, selecting a Myanmar specimen as the type. Hooker had cited specimens from Bhutan (*Griffith*) and Sikkim (*Hooker*) which

Hunt & Summerhayes excluded and which we have redetermined as *C. stricta*. We cannot be sure that *C. holochila* does not occur in Bhutan and Chowdhery (1998) reported it from the Kameng district of Arunachal Pradesh.

C. **rigida** Parish & Rchb. f. in Trans. Linn. Soc. London 30: 146 (1874). Type: Myanmar (Burma), Moulmein, *Parish* s.n., icon.42 (holo. W! Herb. no. 43811).
Coelogyne incarnata Ridley in J. Fed. Malay States Mus. 5: 156 (1915).

NOTE. Reported by Arora (1984) from Sikkim. We have seen no material to confirm this and it has previously only been reported from Myanmar and Thailand (Seidenfaden, 1975) and India (Arunachal Pradesh, Meghalaya and Nagaland: Das & Jain, 1980).

C. **suaveolens** (Lindl.) Hook. f., Fl. Brit. India 5(2): 832 (1890). Type: Country of origin unknown, cult. Bishop of Winchester s.n. (holo. K-LINDL!).
Pholidota suaveolens Lindl. in Gard. Chron. 1856: 372 (1856).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh. We have seen no collections of this species from our area.

79. **Dickasonia** L.O. Williams

Plants epiphytic. *Pseudobulbs* perennial, shiny. *Leaves* lanceolate-elliptic, petiolate. *Flowers* resupinate. *Inflorescence* lateral, racemose, few-flowered. *Sepals* similar, free, keeled dorsally. *Petals* smaller than sepals. *Lip* adnate to the column, immobile, entire, strongly gibbous or saccate at base, ecallose. *Column* short, lacking a foot; anther operculate, incumbent; pollinia 4.

The genus *Dickasonia* was established in 1941 by Louis Otho Williams in the *Botanical Museum Leaflets of Harvard University*. The genus is monotypic and is found in NE India, Bhutan and Myanmar.

Dickasonia is closely related to *Panisea* Lindl. but is distinguished from it by the lip which is adnate to the short column. Within the Coelogyninae only three genera, *Dickasonia*, *Entomorphobia* and *Gynoglottis* J.J. Smith, have an adnate lip.

TYPE. *Dickasonia vernicosa* L.O. Williams.
ETYMOLOGY. Named after Mr F.G. Dickason of Judson College, Rangoon who collected orchids in Myanmar (Burma).

1. *D.* **vernicosa** L.O. Williams in Bot. Mus. Leafl. 9: 37 (1941). Types: Myanmar, Haka, *Dickason* 7377, 7524, 7625 (syns. AMES); Kyanksit Chaung, Chin Hills district, *Dickason* 8576 (syn. AMES!).
Kalimpongia narajitii Pradhan in Orchid Digest 41(5): 172 (1977). Type: India, Ibdia, Manipur, Hengshi village, R.K. *Mohendrajit Sing* s.n. (holo. CAL).

Plant 7–11cm tall. *Pseudobulbs* clustered, obliquely ovoid-conical, angled, mamillate, sheathed at base, 2.5–3cm long; basal sheaths lanceolate-ovate, membranous, dry. *Leaf* 1 (rarely 2), lanceolate to lanceolate-elliptic, acute, membranous, 5- to 7-veined, margins undulate, 3–10.5 × 0.6–2cm; petiole 1.6–2cm long. *Inflorescence* hysteranthous, 3- to 7-flowered; peduncle 2–6cm long; rachis 2.5–4cm long; floral bracts obliquely lanceolate, acuminate, 5-veined, membranous, dry, persistent, 1–1.3 × 0.2–0.3cm. *Flowers* 1–1.3cm long, translucent white; pedicel and ovary 0.8–1cm long. *Sepals* subequal, lanceolate, acute, 1.1–1.4 × 0.3–0.4cm; *lateral sepals* keeled, weakly falcate. *Petals* narrowly lanceolate, acute, 1–1.2 × 0.3–0.4cm. *Lip* entire, spurred, unequally oblong, deflexed, apiculate, margins erose, 5-veined, c.1 × 0.5cm; spur short, rounded. *Column* short, 2.5–4mm long. *Fruit* hexagonal in cross-section, 1.2 × 0.7cm. **Fig. 80.**

Bhutan: C – Tongsa district (Tongsa to Changka); **Darjeeling** (Kalimpong (Pradhan, 1977)). 2400–2500m. Fl. April(–June).

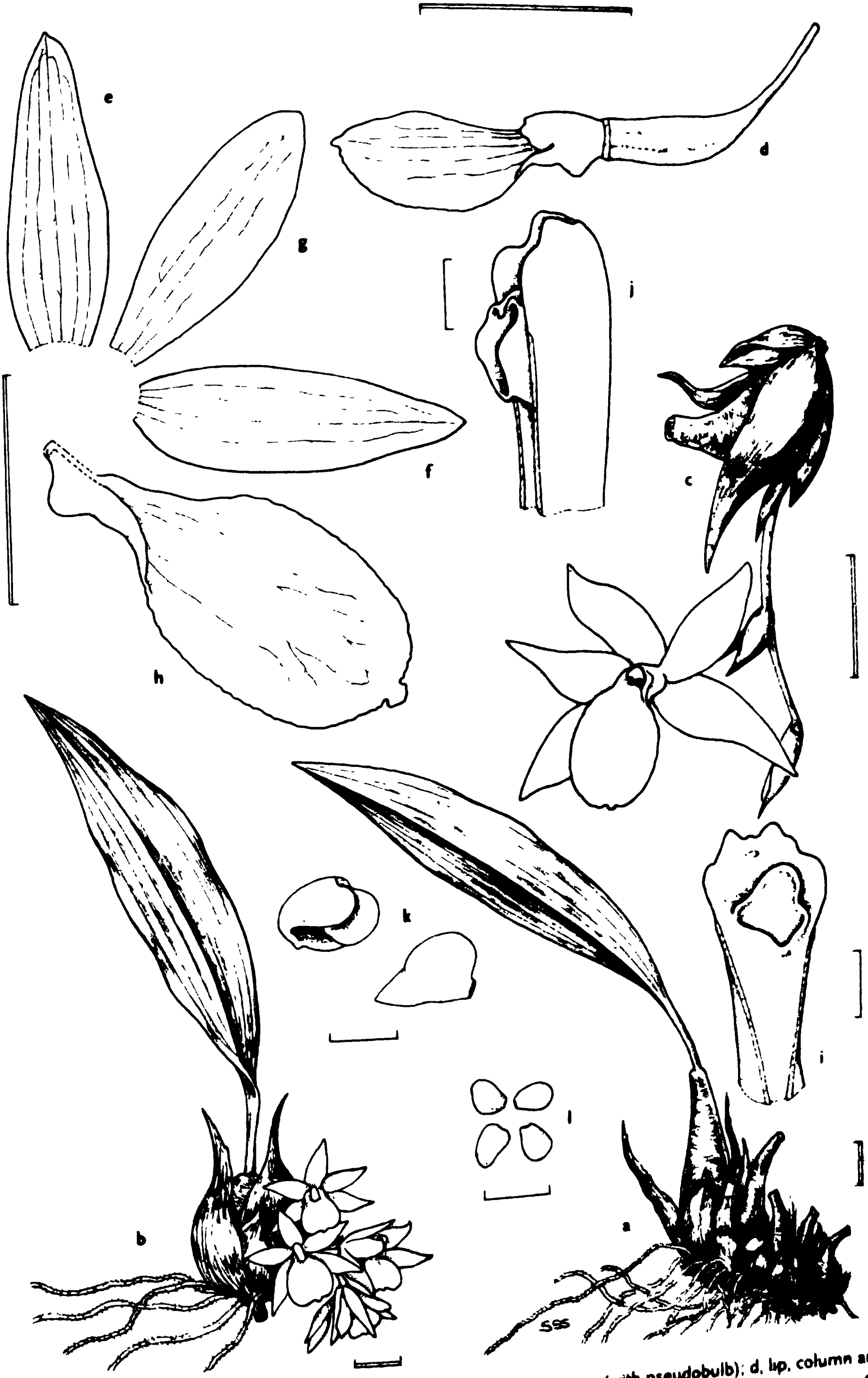


Fig. 80. **Dickasonia vernicosa**: a, habit; b, habit with inflorescence; c, flower (with pseudobulb); d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column (front view); j, column (side view); k, anther cap (two views); l, pollinia. Drawn by Susanna Stuart-Smith from *Venning* 4 (K).

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. From the Latin *vernicosus* (glossy) in reference to the flower.

NOTES. Butzin (1979) examined *Kalimpongia narajitii* Pradhan and found it to be conspecific with *D. vernicosa*. This is the first report of the species from Bhutan.

80. **Neogyna** Rchb. f.

Plants epiphytic or lithophytic. *Pseudobulbs* ovoid-cylindric to conical, sheathed. *Leaves* lanceolate, petiolate. *Inflorescence* racemose, pendent. *Flowers* large, resupinate; ovary and pedicel cylindric, 3-ridged. *Sepals* and *petals* similar, fleshy, campanulate (united and saccate at base). Lip 3-lobed, oblong, funnel shaped, spurless; lateral lobes erect, folded around the column. Column long, curved; rostellum triangular; anther sac oblong; pollinia 4, oblong-pyriform, depressed.

The genus *Neogyna* was established in 1852 by Heinrich Gustav Reichenbach in the *Botanische Zeitung*. It is monotypic and is distributed in India and SE Asia.

This genus is based on *Coelogyne gardneriana* Lindl. and there has been dispute about the validity of its transfer. Lindley (1854) disagreed with Reichenbach and placed the species in its own section of *Coelogyne* after which Reichenbach revised his position. Bentham & Hooker (1883) and Hooker (1890) maintained it within *Coelogyne*. Pfitzer (1889) resurrected the genus which has been followed by most authors since. Seidenfaden (1992), however, considered it debatable as to whether or not this genus should be kept separate from *Coelogyne*. The main features separating it from *Coelogyne* are that the lateral lobes of the lip remain folded around the column and the sepals which all have a saccate base.

Lindley (1852–59) introduced the invalid orthographic variant *Neogyne*.

TYPE. *Neogyna gardneriana* (Lindl.) Rchb. f.; basionym: *Coelogyne gardneriana* Lindl.

ETYMOLOGY. From the Greek *neo-* (new) and *-gynus* (from the related *Coelogyne*) to indicate a new, but related, genus.

1. **N. gardneriana** (Lindl.) Rchb. f. in Bot. Zeitung (Berlin) 10: 931 (1852). Type: Nepal, Noakote, E. *Gardner* (holo. not located); Lectotype (selected here): [icon. in] Wall., Pl. Asiat. Rar. 1: 33, t.38 (1830)!

Coelogyne gardneriana Lindl., in Wall., Pl. Asiat. Rar. 1: 33, t.38 (1830).

C. insaccata Griff., Not. Pl. Asiat. 3: 400 (1851). Type: India, Khasia, *Griffith* 1119 (holo. K-LINDL!).

Neogyna gardneriana var. *basiquinquelamellata* T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 79 (1951). Type: Thailand, Doi Sultep, *Kerr* 205 (holo. K!).

N. gardneriana var. *basitrilamellata* T. Tang & F.T. Wang, loc.cit. (1951). Types: China, Yunnan, *Rock* 7280 (syn. B†); Myanmar, Sadon, *Rock* 7456 (syn. B†).

Plant 30–45cm tall. *Pseudobulbs* ovoid-cylindric to conical, sheathed at base, 12–15 × 0.5–2cm; sheaths broadly ovate, obtuse, membranous, becoming fibrous, 7–9cm long. *Leaves* 2, lanceolate, acute, yellow-green above, pale beneath, 15–40 × 1.8–7cm; petiole 3.5–6.5cm long. *Inflorescence* proteranthous or hysteranthous, 6- to 12-flowered; peduncle sheathed, 15–25cm long; sheaths broad, overlapping, 2.5–3cm long; raceme 7–15cm long; floral bracts broadly ovate to suborbicular, obtuse, thinly membranous, persistent, 1.5–4 × 0.7–1.4cm. *Flowers* 4–4.5cm long, white, keels yellow; pedicel and ovary short, 6–9mm long. *Sepals* and *petals* similar, oblong-linear, acute, united and saccate at base, 3.5–5 × 0.3–0.5cm long. Lip 3-lobed, funnel shaped, 3.5–4 × 1.5cm; lateral lobes large, rounded, narrow, c.3cm long; mid-lobe with apical cleft, margins denticulate, c.1cm long; disc with 2–5 wavy keels. *Column* curved-clavate, c.4cm long. *Fruit* ellipsoid, c.3 × 1.4cm. **Fig. 81.**

Bhutan: S – Gaylegphug district (near Betini (M.F.B.)); C – Ha (Jobjee), Punakha (Dawakha, Neptengka, between Punakha and Tinlegang) and Tashigang (Gamri Chu) districts. On rocks in open jungle; 1550–3533m. Fl. (September–)October–December(–April); Fr. January–May.

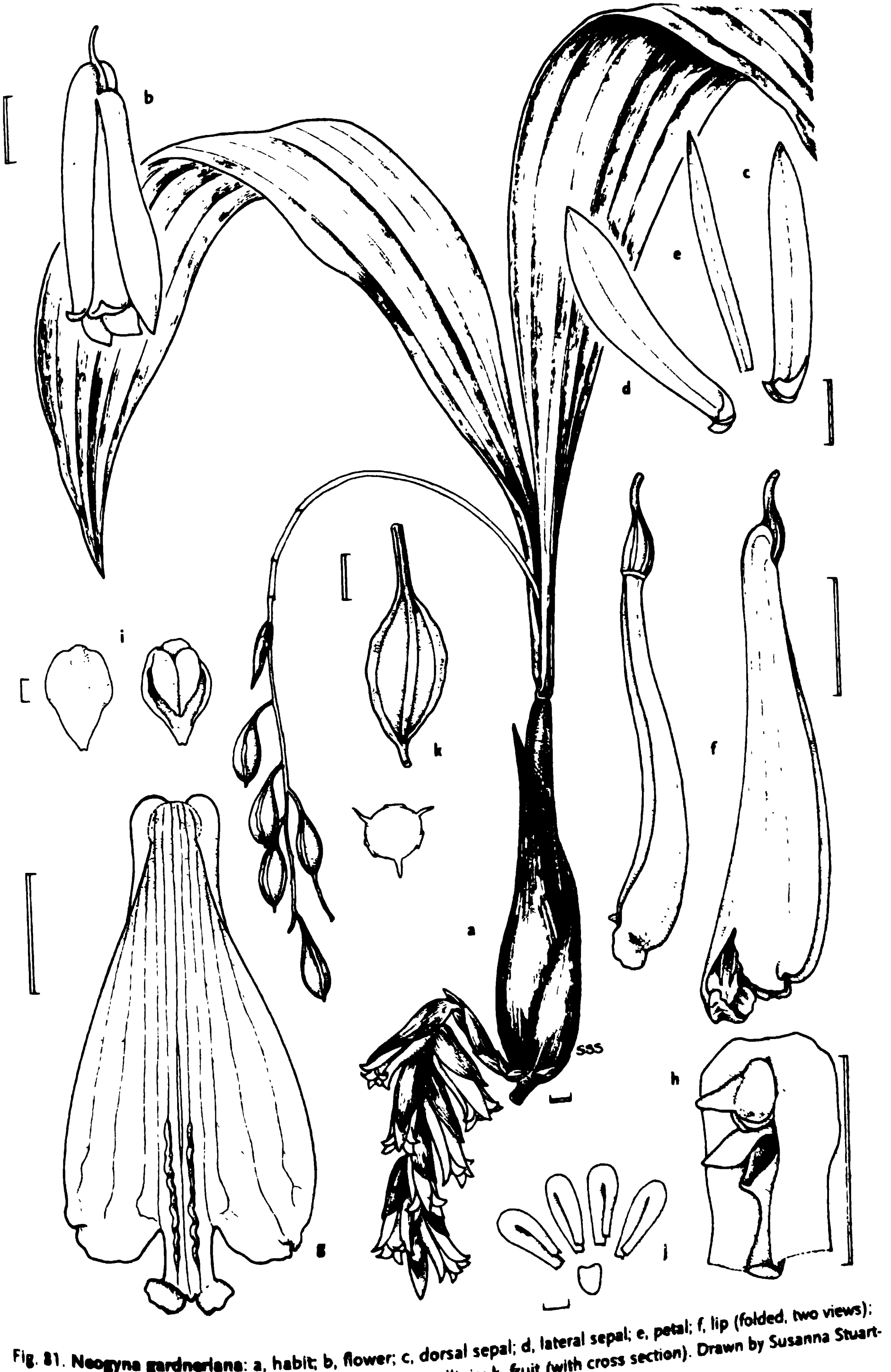


Fig. 81. **Neogyna gardneriana**: a, habit; b, flower; c, dorsal sepal; d, lateral sepal; e, petal; f, lip (folded, two views); g, lip (unfolded); h, column; i, anther (two views); j, pollinia; k, fruit (with cross section). Drawn by Susanna Stuart-Smith from *Parry* 483 (K).

GENERAL DISTRIBUTION. NE India, Myanmar, China and Thailand.
ETYMOLOGY. Named after the Hon Edward Gardner (b. 1784) who worked for the East India Company and was Resident at the Court of the Raja of Nepal. He collected plants for W.J. Hooker and N. Wallich.

81. Otochilus Lindl.

Plants epiphytic, creeping. *Pseudobulbs* arising from (or near) apex of the previous pseudobulb (i.e. superposed), cylindric, fleshy. *Leaves* 2 from pseudobulb apex, linear, elliptic or lanceolate, membranous, plicate, petiolate. *Inflorescence* proteranthous or synanthous, racemose, curved, arising from between leaves, laxly few- to many-flowered. *Flowers* medium in size. *Sepals* and *petals* subequal, free, narrow, spreading. *Lip* sessile at base of column, saccate at base, 3-lobed, ± callose; lateral lobes erect, auriculate; mid-lobe oblong, elongate. *Column* elongate, erect, semi-terete, clavate; anther subterminal, operculate; pollinia 4, paired.

The genus *Otochilus* was established in 1830 by John Lindley in his *Genera and Species of Orchidaceous Plants*. The genus comprises five species distributed in the Himalayas, China, Myanmar, Thailand and Vietnam.

TYPE. *non designatus*.
ETYMOLOGY. From the Greek *otos* (ear) and *cheilos* (lip) in reference to the auriculate lateral lobes of the lip.

Key to species

1. Dorsal sepal more than 1cm long; apex of floral bracts acute .... **3. O. lancilabius**
+ Dorsal sepal less than 1cm long; apex of floral bracts broadly obtuse 2

2. Leaves ovate-lanceolate; lateral lobes of lip finely papillose .... **1. O. albus**
+ Leaves linear-lanceolate; lateral lobes of lip not finely papillose .... **2. O. fuscus**

1. O. albus Lindl., Gen. Sp. Orchid. Pl.: 35 (1830), *sphalm. alba*. Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 1967.1 (holo. K-LINDL!, iso. K-W!).
Broughtonia pendula Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 35 (1830), nom. nud.

Pseudobulbs subcylindric, grooved, enclosed in tubular sheaths when young, 5–7.5 × 0.7–1.3cm. *Leaves* oblong-elliptic, acuminate, 7.5–21 × 1.2–4.5cm; petiole 1–2cm long. *Inflorescence* synanthous, laxly 12- to 16-flowered; peduncle sheathed, 3–7.5cm long; sheaths overlapping, 1–3.5cm long; rachis slender, weakly zigzag, 9–12cm long; floral bracts caducous, ovate-lanceolate, 0.9–1.2 × 0.5–0.8cm. *Flowers* 1–1.8cm across, uniformly white; pedicel and ovary slender, curved, 0.8–1.1cm long. *Sepals* similar, oblong-lanceolate, acute, 0.8–1 × 0.1–0.2cm. *Petals* narrowly oblong-lanceolate, acute, 0.7–1 × 0.1–0.2cm. *Lip* 3-lobed, 5–6mm long, base saccate; lateral lobes broad, acute; mid-lobe oblong, apiculate, deflexed from base. *Column* slender, winged and dilated at apex, 6–7.5mm long. *Fruit* ellipsoid, ridged, 1–1.2 × 0.4–0.5cm.

Darjeeling (Badanthan, Birick, Kurseong); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). 660–2160m. Fl. June–July.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China (Yunnan), Thailand and Vietnam.
ETYMOLOGY. From the Latin *albus* (a dull white) in reference to the flower colour.

2. O. fuscus Lindl., Gen. Sp. Orchid. Pl.: 35 (1830), *sphalm. fusca*. Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 1969 (holo. K-LINDL!, iso. K-W!).
Broughtonia ?amoena Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 35 (1830), nom. nud.
Otochilus lancifolius Griff., Itin. Pl. Khasyah Mts.: 69, no.1074 (1848); Not. Pl. Asiat. 3: 278 (1851); Icon. Pl. Asiat. 3: t.289 (1851). Type: India, Khasia, *Griffith* 1027 (holo. K-LINDL!).
Coelogyne fusca (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 236 (1861).

Pseudobulbs cylindric-fusiform, rugose, pendent, covered with fibrous sheaths, 2.5–7.5(–9) × 1–1.5cm; sheaths overlapping, 1–1.6cm long. *Leaves* linear-lanceolate, acuminate, 8–17.5 × 0.8–1.6cm; petiole 1.2–1.4cm long. *Inflorescence* proteranthous, semi-erect, laxly 14- to many-flowered; peduncle sheathed, 2–5cm long; sheaths overlapping, rugose, 0.6–6cm long (to 9cm on fruiting peduncle); rachis ridged, glabrous, 7–14cm long; floral bracts persistent, linear-oblong, subtruncate, scarious, edges inrolled, 7–8 × 1.5–3mm. *Flowers* fragrant, 1.4–1.6cm across, white, base of lip tinged pink, column orange-brown; pedicel and ovary 4–5mm long. *Sepals* free, subequal, linear-oblong, obtuse, spreading, 7–8 × 1–1.5mm. *Petals* linear-oblanceolate, obtuse, spreading, 4.5–5 × 0.5–1mm. *Lip* 4–6mm long, base shortly saccate; lateral lobes short, erect, rounded, acute; mid-lobe oblong, acute, concave, deflexed. *Column* short, curved, lacking a foot, slightly winged and dilated at apex, 4–5 × 0.8–1mm (at apex). *Fruit* ellipsoid, beaked, 0.9–1.1 × 0.4–0.5cm. **Plate 14.**

Bhutan: S – Samchi (Sangura (M.F.B.)), Phuntsholing (above Rinchending), Chukka (Marichong) and Gaylegphug (Sham Khara (M.F.B.), Raidak Valley, Surelakha (M.F.B.)) districts; C – Punakha (between Bhotokha and Rimchu, Chachuphu, Tinlegang), Tongsa (Tama (M.F.B.), Tongsa to Changkha) and Tashigang (Nyoth (M.F.B.)) districts; **Darjeeling** (Dumsong); **Sikkim** (Tista River Valley near Mangan). Subtropical jungle slopes, on old tree trunks; 780–2500m. Fl. November–June; Fr. December.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand, Cambodia and Vietnam.
ETYMOLOGY. From the Latin *fuscus* (a sombre brown) in reference to the flower colour.

3. **O. lancilabius** Seidenfaden in Bot. Tidsskr. 71: 13, t.11 (1976); Opera Bot. 89: 94 (1986). Type: India, Sikkim, *Pantling* 26 (holo. K!, iso. BM! W!).
Otochilus porrectus sensu Hook. f., Fl. Brit. India. 5(2): 844 (1890), non Lindl.
O. alba var. *lancilabius* (Seidenfaden) Pradhan, Indian Orch.: Guide Identif. Cult. 2: 706 (1979).

Roots borne at internodes. *Pseudobulbs* subcylindric, elongate-fusiform to clavate, sheathed at base, 3–10 × 1.3–2cm. *Leaves* elliptic-lanceolate to oblong-lanceolate, acute to acuminate, 12–25 × 3.6–6.5cm; petiole narrow, 1–3.5cm long. *Inflorescence* proteranthous, decurved, lax; peduncle sheathed when young, 4–6.5cm long; sheaths overlapping, 0.8–1.1cm long; rachis 9–12cm long; floral bracts caducous, linear, broad, acute, c.1.2cm long. *Flowers* 1.5–2.2cm long, white or pale flesh-coloured with pale-brown markings; pedicel and ovary 5–6mm long. *Sepals* subsimilar, linear-oblong, acute, 0.8–1.8 × 0.2–0.45cm; lateral sepals weakly falcate. *Petals* linear, acute, 3-veined, 0.8–1.8 × 0.2–0.35cm. *Lip* 3-lobed, linear-lanceolate, acute, 0.8–1.5 × 0.3–0.5cm, base broadly funnel shaped; lateral lobes erect, short, obtuse; mid-lobe slender lanceolate to elliptic, subacute; disc 3-keeled. *Column* slender, dilated above, curved, winged, 1–1.6cm long; rostellum not protruding; anther cap broadly triangular, obtuse; pollinia globose. Fruit ellipsoid, beaked, 1.5–2 × 0.7–0.9cm. **Fig. 82; Plate 15.**

Bhutan: S – Phuntsholing (Kamji (M.F.B.)) and Chukka (Chasilkha (M.F.B.), Marichong) districts; C – Punakha (Bhotokha to Punakha, between Khelekha and Nobding, below Lamperi, Rimchu to Khosa, Samtengang to Ritang, Tinlegang), Tongsa (Shemgang (M.F.B.), Tashiling, Tingtinbi, Tongsa), Mongar (Khoma) and Tashigang (Yonpu La) districts; **Darjeeling** (Dumsong, Sureil, Victoria Falls); **Sikkim** (Gangtok, Lusing, Penlong La). On trees in evergreen oak forest; 800–3000m.
Fl. October–April; Fr. May–Sepember.

GENERAL DISTRIBUTION. Nepal and India (Himalayas).
ETYMOLOGY. From the Latin *lanci-* (lanceolate) and *labium* (lip).
NOTES. Seidenfaden (1976b) proposed this species as distinct from *O. porrectus* Lindl. but felt hesitant in describing it considering that it might turn out to be a tetraploid form of *O. albus*. Pradhan (1979), having seen living specimens, felt that it was a large-flowered, possibly tetraploid, form of *O. albus* and proposed varietal status for it. Deva & Naithani (1986) and Seidenfaden (1986, 1992) recognised it as a distinct species.

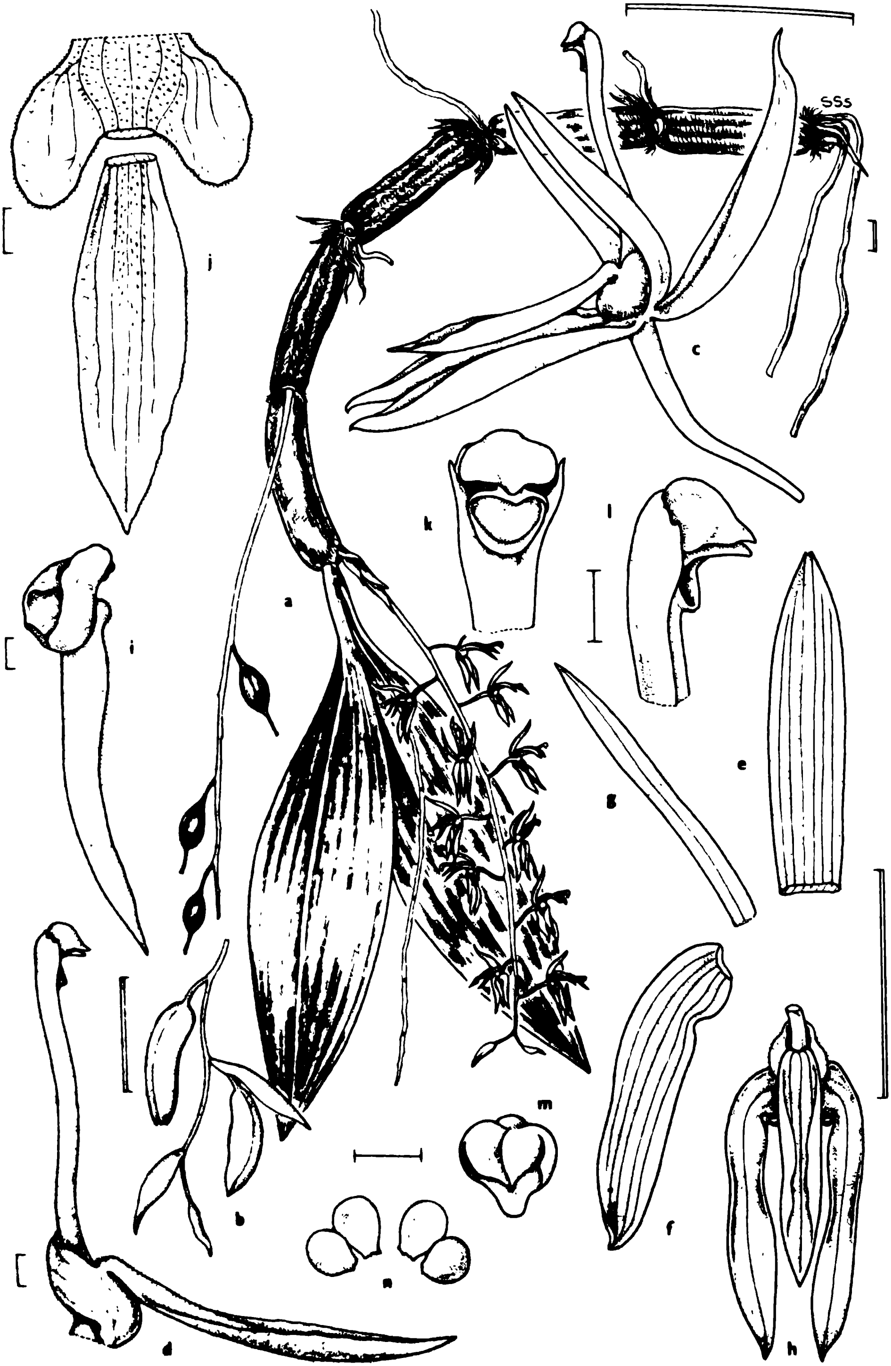


Fig. 82 **Otochilus lancilabius**: a, habit; b, inflorescence; c, flower; d, lip and column; e, dorsal sepal; f, lateral sepal; g, petal; h, lip (with lateral sepals); i, lip (side view); j, lip (flattened, lateral lobes detached); k, column apex (front view); l, column apex (side view); m, anther; n, pollinia. Drawn by Susanna Stuart-Smith, a from *Pantling* 26 (K); b from *Treutler* 949 (K); c–n from *Grierson & Long* 3032 (E)

We have examined these taxa carefully and studied the type material of *O. porrectus* Lindl. It is clear that these are distinct species with *O. porrectus* having large, erect lateral lobes and a protruding, beaked rostellum. The lip base of *O lancilabius* is funnel shaped, with small lateral lobes, the lip is longer and narrower and the rostellum does not protrude.

Doubtfully recorded and imperfectly known species.

O. porrectus Lindl., Gen. Sp. Orchid. Pl.: 36 (1830), *sphalm. porrecta*. Type: Bangladesh, Pandua, coll. *F. De Silva* Wall. Cat. 1968 (holo. K-LINDL!, iso. K-W!).
Tetrapeltis fragrans Wall. ex Lindl. in Bot. Reg. 18: sub t.1522 (1832). Type without provenance, icon. Wallich 121 (holo. K!).
Otochilus latifolius Griff., Not. Pl. Asiat. 3: 279 (1851). Type: India, Khasia, *Griffith* s.n. (holo. K-LINDL!).
Coelogyne porrecta (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 236 (1861).
Otochilus fragrans (Wall. ex Lindl.) Nicholson, Ill. Dict. Gard. 2: 534 (1886).
O. forrestii W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 13: 216 (1921). Type: China, Yunnan, *Forrest* 9371 (holo. E).

NOTE. Reported from our area and neighbouring Arunachal Pradesh by Chowdhery (1998), but we consider that these reports refer to the closely related *O. lancilabius* Seidenfaden (see notes above).

82. **Panisea** (Lindl.) Steudel

Plants small, epiphytic or lithophytic; rhizome branched, short. *Pseudobulbs* 1-noded, ovoid to obliquely ovoid. *Leaves* arising from pseudobulb apex, narrowly elliptic to linear, petiolate or subsessile. *Inflorescence* proteranthous, hysteranthous or heteranthous, racemose, 1- to several-flowered. *Flowers* small to medium in size. *Sepals* and *petals* subsimilar, free. *Lip* entire or 3-lobed, sigmoidally curved at base; callose or ecallose. *Column* slender, incurved, hooded at apex; foot short; pollinia 4, waxy, superposed.

The name *Panisea* was first proposed in 1830, as a section within *Coelogyne*, by John Lindley in his *Genera and Species of Orchidaceous Plants*. In 1841, E.G. Steudel raised the section to generic rank in his *Nomenclator Botanicus*. The genus comprises seven species distributed in N India, Nepal, Bhutan and SE Asia.

The genus has been monographed by Lund (1987a) and the Indian species have been revised by Phukan (1993).

TYPE. *Panisea parviflora* (Lindl.) Lindl.; basionym: *Coelogyne parviflora* Lindl.
ETYMOLOGY. From the Greek *pan-* (all) and *iso* (equal) in reference to the similarity of the floral segments.

Key to species

1. Lip with falcate lateral lobes .... **3. P. uniflora**
+ Lip lacking lateral lobes 2
2. Inflorescence 5- to 8-flowered; lip lacking callus .... **1. P. demissa**
+ Inflorescence 1-flowered; lip with 3 small calluses .... **2. P. tricallosa**

1. P. demissa (D. Don) Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 141, t.49 (1907). Type: Nepal, Gossainthan, *Wallich* s.n. (holo. BM!).
Dendrobium demissum D. Don, Prodr. Fl. Nepal.: 34 (1825).
Coelogyne parviflora Lindl., Gen. Sp. Orchid. Pl.: 44 (1830). Type: Nepal, Gossainthan, *Wallich* s.n. (holo. K-LINDL!).

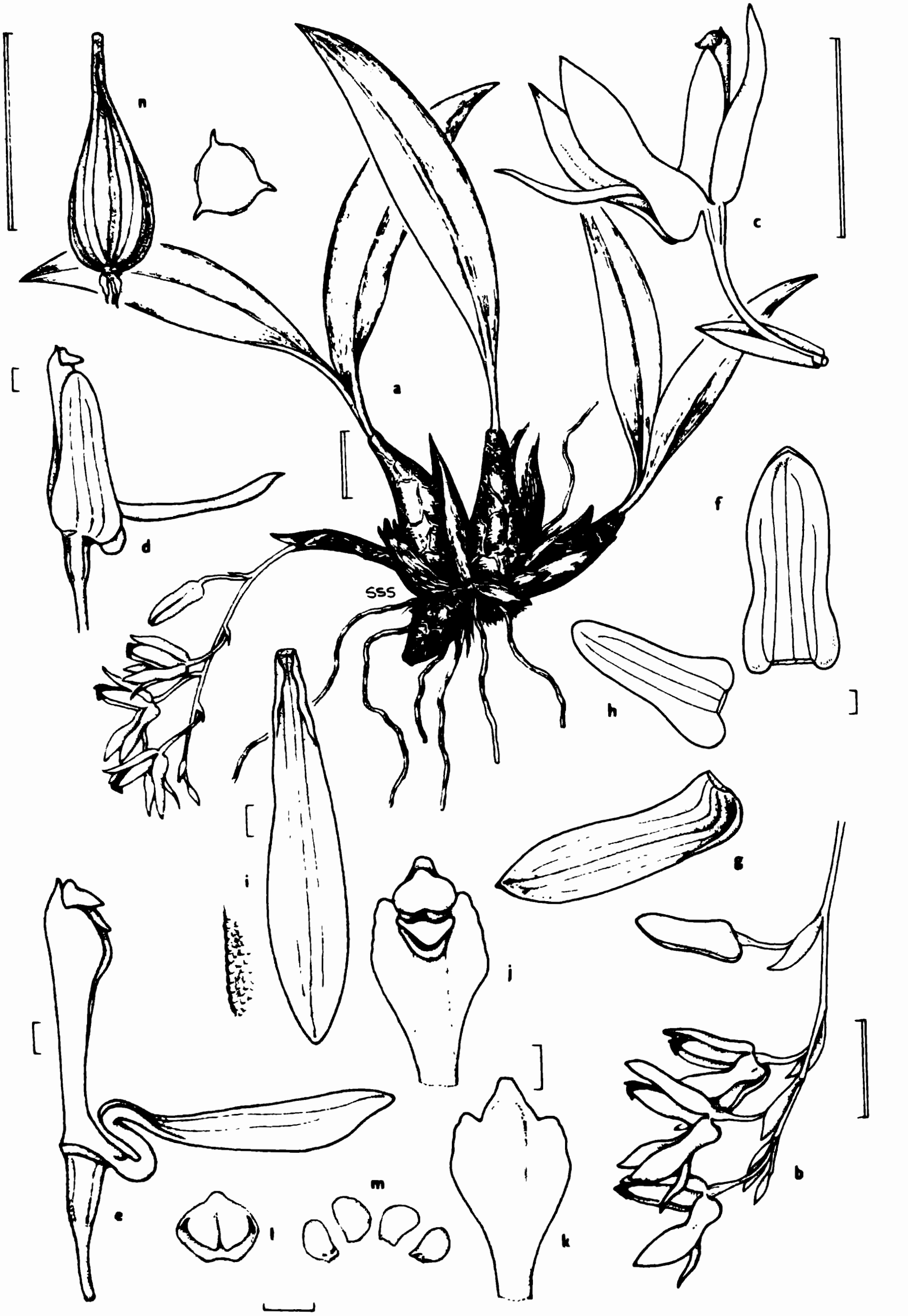


Fig. 83 **Panisea demissa**: a, habit; b, inflorescence; c, flower with bract; d, lip, column, lateral sepals and ovary; e, lip column and ovary, f, dorsal sepal; g, lateral sepal; h, petal; i, lip (with detail of surface); j, column apex (front view); k, column apex (back view), l, anther; m, pollinia; n, fruit (with cross section). Drawn by Susanna Stuart-Smith, a–b from *White & Sharma* 202 (K); c–m from *Grierson & Long* 3704 (K); n from *Meebold* 7091 (K).

Panisea parviflora (Lindl.) Lindl., Fol. Orchid. Panisea 5: 1, no.1 (1854).
P. reflexa Lindl., op. cit. no.2 (1854). Type: India, Assam, *Griffith* s.n. (holo. K-LINDL!).
P. demissa var. *reflexa* (Lindl.) Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 141 (1907).

Plant epiphytic, 4–8cm tall. *Pseudobulbs* clustered, narrowly ovoid to ovoid, 1.5–4 × 0.6cm. *Leaves* 1 or 2, lanceolate or elliptic-lanceolate, acute, 3–8 × 0.7–1.5cm; petiole 4–8mm long. *Inflorescence* proteranthous, decurved, laxly 5- to 8-flowered; peduncle slender, sheathed at base, 1–2cm long; rachis 2–3.5cm long; floral bracts ovate, acute, membranous, persistent, 6–7 × 1–1.8mm. *Flowers* 1–1.2cm across, white; pedicel and ovary slender, 6–9mm long. *Sepals* similar, oblong-lanceolate, weakly saccate at base, dorsally keeled, 0.8–1.2 × 0.3cm. *Petals* oblong, obtuse, 0.8–1.2 × 0.2cm. *Lip* simple, oblong, subacute, sigmoidally bent, narrow at base, 3-veined, ecallose, 0.8–1.2 × 0.2cm. *Column* winged, c.8mm long; pollinia c.0.5mm long. Fruit obovoid, ridged, 8–9 × 4–5mm. **Fig. 83; Plate 15.**

Bhutan: S – Sarbhang district (2km below Dara Chu on Chirang road); **C** – Punakha district (Samtengang to Ritang); **Darjeeling** (Mongpu); **Sikkim** (unlocalised King and Pantling specimens); **Sikkim/Chumbi** (Yak La). 1900–3300m. Fl. October–November(–March); Fr. April.

GENERAL DISTRIBUTION. Nepal, NE India, China, Myanmar, Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *demissus* (low, humble).

2. **P. tricallosa** Rolfe in Kew Bull.: 148 (1901). Type: India, Assam, cult. Glasnevin B.G. (holo. K!).
Stigmatogyne tricallosa (Rolfe) Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 133 (1907).
S. pantlingii Pfitzer in Engler, op. cit. 134 (1907). Type: India, Assam, *Watt* (holo. B).
Panisea pantlingii (Pfitzer) Schltr., Orchideen: 155 (1915).
Stigmatogyne bia Kerr in J. Siam Soc., Nat. Hist. Suppl. 9(2): 236, f.5 (1933). Type from Laos.
Panisea bia (Kerr) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 79 (1951).
P. tricallosa var. *garettii* I.D. Lund in Nordic J. Bot. 7(5): 524 (1987). Type from Thailand.

Plant epiphytic, 5–7cm tall. *Pseudobulbs* caespitose, ellipsoid-obovoid, 1–2.5 × 0.7–1cm. *Leaves* 1 or 2, elliptic-lanceolate, lanceolate or linear, 3-veined, petiolate, 3–12 × 1–1.7cm; petiole 1–1.5cm long. *Inflorescence* proteranthous, 1-flowered; peduncle covered by overlapping sheaths, 1–1.3cm long; floral bract scarious, brown, 6–7 × 3–5mm. *Flower* 2–2.5cm across, pale yellow to greenish, lip with 3 small spots at base, calluses on disc orange, column pale yellow; pedicel and ovary winged, c.1.2cm long. *Sepals* subsimilar, ovate-oblong, acute, 5-veined, 1.3–1.8 × 0.4–0.7cm; *lateral sepals* weakly saccate at base. *Petals* oblong, acute to acuminate, 3-veined, 1.3–1.8 × 0.4cm. *Lip* simple, obovate-oblong to spathulate, truncate, apiculate to suborbicular, sigmoid at base, 1.5–1.9 × 0.8–1.2cm; disc with 3 small calluses. *Column* winged, c.7mm long. Fruit obovoid, hexagonal in cross-section, 1.8–2.3 × 1.1–2.2cm.

Bhutan: S – Deothang district (between Deothang and Narfong (M.F.B.)); **C** – Tashigang district (Shali to Tashi Yangtsi). Growing on rock in open oak forest; 1700–2160m. Fl. March–November.

GENERAL DISTRIBUTION. Nepal, NE India, China, Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *tri-* (three) and *callus* (ornaments on the lip).

3. **P. uniflora** (Lindl.) Lindl. in Fol. Orchid. Panisea 5: 2, no.4 (1854). Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 1966 (holo. K-LINDL!, iso. K-W!).
Coelogyne uniflora Lindl., Gen. Sp. Orchid. Pl.: 42 (1830).
C. thuniana Rchb. f. in Allg. Gartenzeitung 23: 145 (1855). Type: Nepal, cult. Josst (holo. B).
C. biflora Parish & Rchb. f. in Gard. Chron. 1865: 1035 (1865). Type: Myanmar (Burma), *Parish* (holo. W! Herb. no.43780).
C. falcata T. Anderson ex Hook. f. in Ann. Roy. Bot. Gard. (Calcutta) 5: 29, t.43 (1895). Type: India, Darjeeling, icon. Anderson (holo. K, not found).
Chelonistele biflora (Parish & Rchb. f.) Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 139 (1907).

Plant epiphytic or lithophytic, 9–20cm tall; *rhizome* creeping, covered with closely overlapping scales. *Pseudobulbs* caespitose, ellipsoid to ovoid, smooth and glossy when fresh, sheathed at base, 1.7–3.5 × 0.4–1.5cm; sheaths oblong-lanceolate, acuminate, scarious, 1.7–4 × 1–1.3cm. *Leaves* 2, linear-oblong, acute to acuminate, coriaceous, 3- to 5-veined, subsessile, 5–17 × 0.6–1.2cm; petiole grooved, 5–8mm long. *Inflorescence* proteranthous or heteranthous, erect, lateral, 1-flowered; peduncle c.1.8cm long; floral bract ovate, acute, persistent, 4–5mm long. *Flower* 2–2.5cm across, pale apricot to yellowish, lip with 3–7 orange spots on lateral lobes; pedicel and ovary 0.8–1.6cm long. *Sepals* subsimilar, oblong-lanceolate, acuminate, spreading, 3- to 5-veined; *dorsal sepal* 1.4–1.8 × 0.3cm; *lateral sepals* 1.3–1.7 × 0.4cm. *Petals* lanceolate-elliptic, acuminate, 1.2–1.8 × 0.2–0.7cm. *Lip* obscurely 3-lobed, 1.3–1.7 × 0.8–1cm; lateral lobes short, falcate, weakly saccate at base, 7–9 × 2mm; mid-lobe 1–1.2 × 0.7–1cm; disc with 2 or 3 obscure keels. *Column* curved, broadly winged, 6–9mm long; foot c.2mm long. *Fruit* obovoid to ellipsoid, 1.7–2.2 × 1–1.2cm. **Plate 15.**

Bhutan: S – Phuntsholing district (Phuntsholing); **Sikkim** (unlocalised Hooker and Pantling specimens). In tropical valleys; 500–900m. Fl. April–June.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *uni-* (one) and *flos* (flower).

83. **Pholidota** Lindl. ex Hook.

Plants pendent or erect, epiphytic or lithophytic. *Pseudobulbs* close or distant on rhizome, slender or swollen. *Leaves* 1 or 2, narrowly elliptic, ovate or oblong, petiolate, coriaceous or herbaceous. *Inflorescence* terminal from pseudobulb apex, slender, racemose, distichous, pendent, laxly to densely many-flowered; floral bracts, large, concave. *Flowers* small, fleshy, resupinate or non-resupinate. *Dorsal sepal* concave or convex, boadly ovate to elliptic; *lateral sepals* concave or convex, ovate to ovate-oblong, often keeled. *Petals* ovate to linear. *Lip* sessile, base saccate; epichile subentire, or 3- or 4-lobed, deflexed. *Column* short, apex broadly hooded; pollinia 4.

The genus *Pholidota* was established in 1825 by W.J. Hooker in his *Exotic Flora*. The genus comprises 29 species distributed in tropical SE Asia, the Malay Archipelago, Australia and the Pacific Islands. The genus has been monographed by de Vogel (1988), where a thorough synonymy can be found.

TYPE. *Pholidota imbricata* Hook.
ETYMOLOGY. From the Greek *pholidotos* (covered with scales) in reference either to the floral bracts, or to the pseudobulb sheaths.

Key to species

1. Pseudobulbs superposed; each new shoot developing from apex of previous pseudobulb 2
+ Pseudobulbs caespitose, never superposed; each new shoot developing from base of a pseudobulb 3

2. Floral bracts not secund, falling before fruiting; lip clearly lobed; rachis zigzag **1. P. articulata**
+ Floral bracts secund, persistent until after fruiting; lip simple; rachis not zigzag .. **2. P. recurva**

3. Rhizome pendent; aerial roots present; pseudobulbs spreading from all sides of rhizome **4. P. protracta**
+ Rhizome creeping; aerial roots absent; pseudobulbs on one side of rhizome only 4

4. Pseudobulb with 1 leaf 5
+ Pseudobulb with 2 leaves 6

5. Mature leaves thick-textured, coriaceous; floral bracts with many, dense, fine veins; lateral sepals free at base .... **5. P. imbricata**
+ Mature leaves thin-textured, herbaceous; floral bracts with few, coarse veins; lateral sepals connate at base .... **6. P. pallida**

6. Bracts persistent during flowering .... **3. P. rubra**
+ Bracts caducous at flowering .... **7. P. missionariorum**

Section **Articulatae** (Rchb. f.) Pfitzer in Engler, Nat. Pflanzenfam. 2: 6 (1888).

1. **P. articulata** Lindl., Gen. Sp. Orchid. Pl.: 38 (1830). Lectotype: Bangladesh, Pandua, coll. F. *De Silva* Wall. Cat. 1992 (K-LINDL!, iso. G, K! K-W!), designated by de Vogel in Orchid Monographs 3: 22 (1988).

Pholidota khasyana Rchb. f. in Bonplandia 4: 329 (1856). Type: India, Khasia, *Lobb* 53 (iso. W! Herb. no. 20385)

Coelogyne articulata (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 238 (1861).

Pholidota griffithii Hook. f., Fl. Brit. India 5(2): 845 (1890). Types: India, Sikkim, *Griffith* 5045 (syn. K!); Sikkim, *Hooker* s.n. (syn. K!); India, Khasia Hills, *Clarke* 7331 (syn. K!).

P. obovata Hook. f., *loc. cit.* (1890). Lectotype: India, E Himalaya, *Griffith* 5034 (K!).

P. articulata var. *griffithii* (Hook. f.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 147, t.204 (1898).

P. articulata var. *obovata* (Hook. f.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 40, 79 (1951).

Plant epiphytic, 24–53cm long; *aerial roots* 7–10cm long. *Pseudobulbs* slender to swollen, 3.5–9cm long; sheaths papery-herbaceous, lignified, 0.2–3cm long. *Leaves* ovate to linear-lanceolate, acute to acuminate, 6–13 × 1.5–3.5cm; petiole 0.7–1.5 × 0.15–0.3cm. *Inflorescence* synanthous, 10- to 30-flowered; peduncle 1.4–3.5cm long; rachis straight to zigzag, 3.5–7cm long; internodes 1.5–5mm long; floral bracts distichous, suborbicular-oblong to ovate-oblong, obtuse, papery-herbaceous, veined, 0.5–1.5 × 0.3–1cm. *Flowers* resupinate, fragrant (of chocolate); sepals, petals and lip white-cream to greenish-pink, keels of lip buff, column whitish to purple-red; pedicel and ovary terete, curved, 0.3–1cm long. *Dorsal sepal* ovate to ovate-oblong, obtuse, 5-veined, 4–9 × 1.8–4mm; *lateral sepals* ovate to ovate-lanceolate, acute to acuminate, 4–9.5 × 1.5–4.5mm. *Petals* ovate to ovate-lanceolate, obtuse to acuminate, 3- to 5-veined, 4–8 × 1.5–3.5mm. *Lip* constricted in middle, 4–8mm long; hypochile boat-shaped, inflated, tapering, 5-keeled in basal half, 3–6.5 × 1.3–4mm; epichile recurved, 2-lobed, lobules rounded, finely papillose, 1.5–4 × 2–5mm. *Column* shortly clavate, hooded, 1.5–4.5mm long. *Fruit* ridged, 1–2.1 × 0.5–1cm. **Fig. 84; Plate 15.** 349

Bhutan: S – Samchi (Chepuwa Khola), Phuntsholing (Rinchending, W bank of Torsa River), Gaylegphug (near Mao River Bridge; Rani Camp (M.F.B.), Surelakha) and Deothang (7km from Narfong (M.F.B.)) districts; **C** – Punakha (between Wache and Ngawang, 2km below Tinlegang), Mongar (Saling) and Tashigang (Nangadzong (M.F.B.)) districts; **Terai** (unlocalised *Hooker* specimen); **Darjeeling** (Kalimpong, Tista River Valley); **Sikkim** (Gangtok Orchid Sanctuary). On trees at jungle margins and in ravines, on large cliff in evergreen forest, on wet southern slopes growing on *Schima wallichii* in partly cleared forest; 300–2330m. Fl. April–September; Fr. June–October.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, Thailand, Cambodia, Vietnam to Sumatra, Java, Borneo and Sulawesi.

ETYMOLOGY. From the Latin *articulatus* (jointed) in reference to the rhizomes.

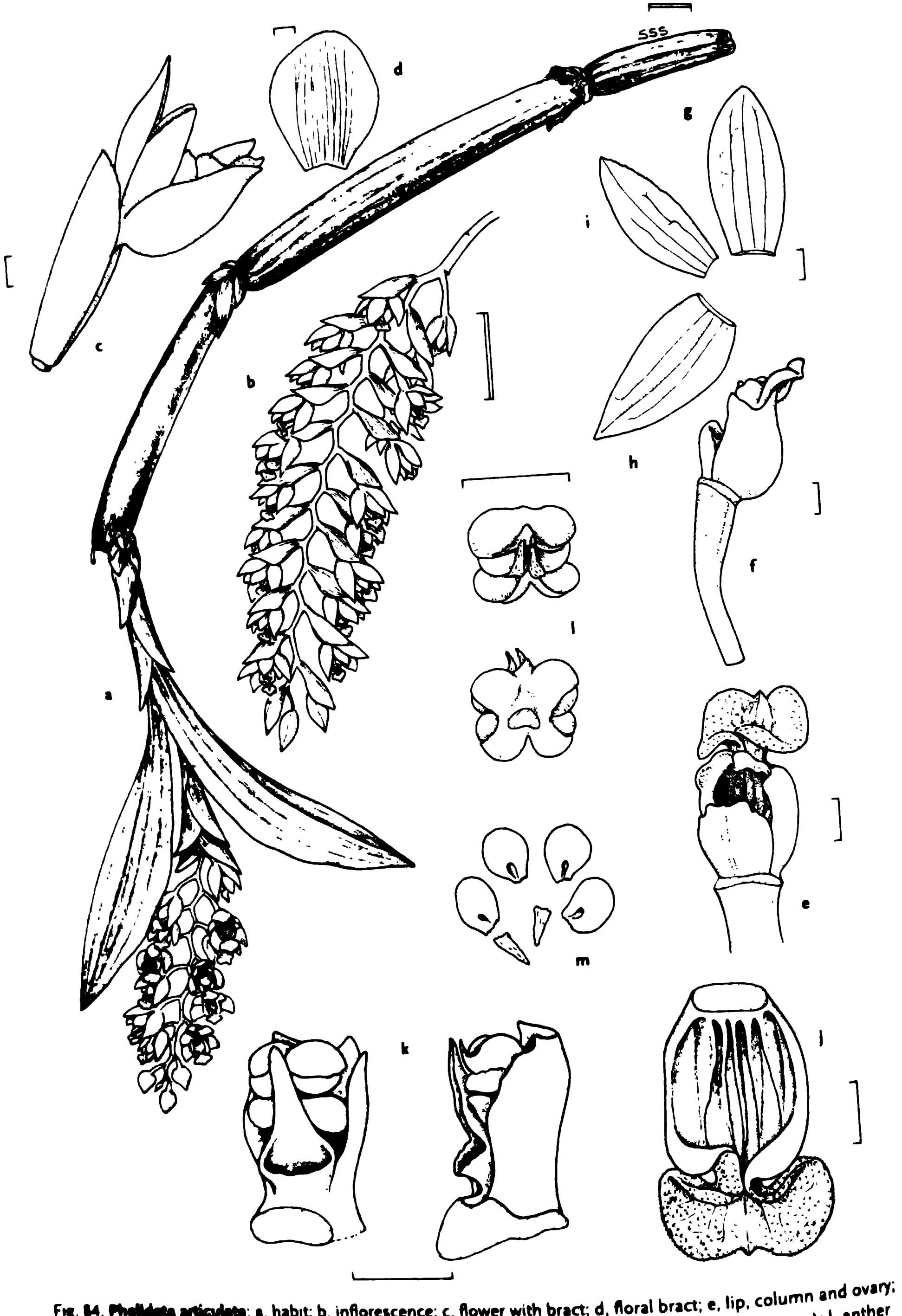


Fig. 84. **Pholidota articulata**: a, habit; b, inflorescence; c, flower with bract; d, floral bract; e, lip, column and ovary; f, lip column and ovary (side view); g, dorsal sepal; h, lateral sepal; i, petal; j, lip; k, column (two views); l, anther (two views); m, pollinia. Drawn by Susanna Stuart-Smith, a from *Grierson & Long* 1408 (E); b–m from cult. Kew 317-1930 (K)

2. **P. recurva** Lindl., Gen. Sp. Orchid. Pl.: 37 (1830). Type: Nepal, without precise locality, *Wallich* s.n. (holo. K-LINDL!, iso. K!).
Coelogyne recurva (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 237 (1861).

Plant epiphytic, 14–45cm long; *aerial roots* 10–17cm long. *Pseudobulbs* swollen, slender, rugose when dry, 2–6.5cm long; sheaths slender, 2–6.5cm long. *Leaves* lanceolate to linear-lanceolate, acute, 3- to 5-veined, 3–7 × 0.9–1.8cm; petiole 3–5mm long. *Inflorescence* synanthous, 24- to 35-flowered; peduncle 0.6–1.5cm long; rachis curved, 4–6.5cm long; internodes c.2mm long; floral bracts distichous, transversely semi-elliptic, oblique, 4–6.5 × 6–8mm. *Flowers* secund, pale pinkish-brown to orange-brown; pedicel and ovary 3–5mm long. *Dorsal sepal* ovate, obtuse, 3- to 5-veined, 3.2–4 × 1.8–2.3mm; *lateral sepals* ovate to ovate-oblong, acute to apiculate, 3.3–4 × 1.5–2.2mm. *Petals* ovate-oblong, obtuse, 2.7–3.3 × 0.6–1mm. *Lip* 3.5–4mm long; hypochile wide, concave, 2.5–3.3 × 2.5–3.5mm; hypochile base with 3 low, swollen keels; epichile small, faintly 2-lobed, 0.7–1 × 2–2.5mm. *Column* clavate, hooded, 2.3–3mm long. *Fruit* c.5 × 4mm.

Darjeeling (Lebong); **Sikkim** (unlocalised *Hooker, King* and *Pantling* specimens). 700–1800m. Fl. August–September.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand and Vietnam.
ETYMOLOGY. From the Latin *recurvus* (recurved) in reference to the inflorescence.

Section **Chinenses** (Rchb. f.) de Vogel in Orchid Monographs 3: 41 (1988).

3. **P. rubra** Lindl., Gen. Sp. Orchid. Pl.: 37 (1830). Type: India, *Wallich* s.n. (holo. K-LINDL!).
Pholidota undulata Lindl. in Bot. Reg. 14: 1213 (1829), *nom. nud.*; Gen. Sp. Orchid. Pl. 37 (1830). Type: India, icon. Wallich 691 (holo. K!).
Coelogyne rubra (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 238 (1861).
C. undulata (Lindl.) Rchb. f., *loc. cit.* (1861).

Plant epiphytic, 18–40cm tall; *rhizome* scales 4, obtuse to acute, disintegrating into slender caducous fibres when old, 0.5–3.5cm long. *Pseudobulbs* cylindric, bulging below the centre, tapering to each end, 0.5–1.7cm apart, 3–9cm long; sheaths 2, longest 4–5cm long. *Leaves* 2 per pseudobulb, linear-lanceolate, acuminate, 3- to 5-veined, 12–23 × 1.8–4cm; petiole 2–3cm long. *Inflorescence* proteranthous to synanthous, 30- to 60-flowered; peduncle wiry, 0.3–3cm long (elongating in fruit); rachis pendent, straight to curved, 11–22cm long; internodes 3–7mm long; floral bracts ovate to elliptic, acute, inrolled, reflexed, papery, 7–11 × 4–5.2cm. *Flowers* opening widely, non-resupinate; sepals dull red, greenish-yellow to pale brownish-yellow, lip light green, yellow, pinkish to white; pedicel and ovary angular, 3–6.5mm long. *Dorsal sepal* ovate, acute to acuminate, 4.3–5.5 × 2–3.6mm; *lateral sepals* ovate to obliquely elliptic, acute to acuminate, recurved to reflexed, 4.5–6 × 2.5–3.2mm. *Petals* linear-lanceolate, obtuse to subacute, 1-veined, 4.3–5.2 × 0.4–0.8mm. *Lip* 4–5.5mm long; hypochile broadly ovate, 2.3–3.5 × 1.5–2.3mm; epichile reflexed to recurved, semi-orbicular to ovate, apex apiculate, ecallose, 1.7–2.3 × 1.5–2.3mm. *Column* slender, hooded, 3–4mm long. *Fruit* ellipsoid, 11–14 × 6–7mm.

Bhutan: S – Chukka district (Chaislakha (M.F.B.)); **Darjeeling** (Munsang); **Sikkim** (Lusing, Tendong). 850–2000m. Fl. October–February.

GENERAL DISTRIBUTION. NE India and Vietnam.
ETYMOLOGY. From the Latin *ruber* (red) in reference to the colour of the sepals and petals.
NOTE. De Vogel (1988) reported that the plants were probably autogamous because a very high proportion of the flowers set fruit.

Section **Crinonia** (Bl.) Butzin in Willdenowia 7: 258 (1974).

4. **P. protracta** Hook. f., Icon. Pl. ser.3, 19: t.1877 (1889). Types: India, Sikkim Himalaya, Neebong, *Clarke* 25229 (lecto. K!, designated by de Vogel in Orchid Monographs 3: 56 (1988)); India, Naga Hills, *Prain* 27 (syn. K!); India, Darjeeling, *Griffith* 5042 (syn. K!).

Plant epiphytic or lithophytic, 17–90cm long; *roots* filiform; rhizome pendent; rhizome scales 3–6, papery, 0.4–2.5cm long. *Pseudobulbs* slender, conical, curved, 2–9cm long; sheaths 2, papery, 2.5–6cm long. *Leaves* lanceolate to linear, acuminate, 3.5–11 × 1–2.3cm; petiole 0.2–1cm long. *Inflorescence* heteranthous, 1 to several from rhizome, arising between pseudobulbs, 4- to 10-flowered; peduncle 0.7–1.3cm long; rachis straight to weakly zigzag, 1–3cm long; internodes 1–3mm long; floral bracts reniform to broadly ovate, obtuse to acute, 2.5–4 × 3–4.2mm. *Flowers* c.5mm across, cream coloured; pedicel and ovary 0.5–2cm long. *Dorsal sepal* ovate, obtuse, 3.8–4.2 × 2–2.3mm; *lateral sepals* ovate to ovate-oblong, acute, 5–5.8 × 2.5–3mm. *Petals* ovate to obovate, acute to obtuse, 3.3–4 × 1.5–2.1mm. *Lip* 4.2–5.5mm long; hypochile shallow, lateral margins lobe-like, 2.5–3.7 × 1.7–2.5mm; epichile ovate, semi-orbicular to subrectangular (when spread), apex retuse, 1.1–2 × 1.8–2.3mm. *Column* spathulate-clavate, hooded, 3–4mm long; foot 0.2–0.4mm long. *Fruit* obovoid to ellipsoid, 3-angled, 0.8–1.1 × 0.4–0.6cm.

Bhutan: C – Punakha (Samtengang to Ritang, Ritang Valley, Tinlegang) and Tashigang (Nyoth (M.F.B.)) districts; **Darjeeling** (unlocalised *Gamble* and *Griffith* specimens); **Sikkim** (Neebay). 1500–2350m. Fl. October–November; Fr. May.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and China (Yunnan).
ETYMOLOGY. From the Latin *protractus* (lengthened, drawn-out).

Section **Pholidota**

5. **P. imbricata** Hook., Exot. Fl. 2: t.138 (1825). Lectoype: based on [icon. in] Hook., Exot. Fl. 2: t. 138 (1825)!, designated by Seidenfaden in Opera Bot. 89: 102 (1986).

Ptilocnema bracteatum D. Don, Prodr. Fl. Nepal.: 33 (1825). Types: Nepal, *Buchanan-Hamilton* (syn. BM), *Wallich* s.n. (syn. BM).
Cymbidium imbricatum Roxb., Fl. Ind. ed.1832, 3: 460 (1832).
Coelogyne imbricata (Roxb.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 238 (1861).
Pholidota assamica Regel in Gartenflora 39: 607 (1890). Type: India, Assam, cult. Sander (holo. B†).
P. henryi Kränzlin in Vierteljahrsschr. Naturf. Ges. Zürich 60: 427 (1915). Type: China, Yunnan, *Henry* 13488 (holo. K!).
P. imbricata var. *henryi* (Kränzlin) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 40, 79 (1951).
P. pallida sensu Holttum, Orchid Malaya ed.3: 237 (1964), non Lindl.
P. bracteata (D. Don) Seidenfaden in Opera Bot. 89: 100 (1986).

Plant epiphytic, occasionally terrestrial or lithophytic, 10–66cm tall; *roots* c.25 × 0.05–0.2cm. *Pseudobulbs* ovoid-conical, sturdy, sheathed at base, 2–11 × 1–1.4cm; sheaths conspicuous, lanceolate, acute, 2–13 × 0.5–0.8cm. *Leaf* single from pseudobulb apex, oblong, obovate-oblong to linear-lanceolate, acute to acuminate, coriaceous, 17–52 × 1.6–9cm; petiole grooved, 0.1–1cm long. *Inflorescence* synanthous, densely many-flowered; peduncle narrowly wiry, terete, glabrous, sheathless, 2–46cm long; rachis 5–41cm long; floral bracts ovate to broadly ovate, acute to obtuse, puberulent to mucilaginous, membranous to papery, yellow-green to light brown with darker spots, 0.5–1.2 × 0.6–1cm. *Flowers* non-resupinate, overlapping, 5–6mm across, white to cream-coloured, tinged yellowish, greenish or pinkish, lip with 1 or 2 yellow-orange spots centrally; pedicel and ovary 4–9 × 1.5–3mm. *Dorsal sepal* ovate, obtuse to acute, usually 5-veined, forming a hood with the petals, 5–6 × 3–4mm; *lateral sepals* ovate-oblong, acute, 4- or 5-veined, 5–7 × 2.5–3.5mm. *Petals* falcate, acute, usually 1-veined, 4.5–6 × 1.3–2.2mm. *Lip* broadly 3-lobed, broadly inserted, base concave, 0.5–0.9 × 0.6–1cm; lateral lobes erect, triangular to semi-orbicular; mid-lobe deeply 2-lobed, retuse in front, lobes semi-elliptic to semi-orbicular; disc with 3 short, wing-like keels at base. *Column* 2.5–3.5mm long. *Fruit* ellipsoid, 0.9–1.6 × 0.6–0.9cm.

Bhutan: S – Sarbhang district (near Lao Pani, 12km E of Sarbhang); **Terai** (Sivok); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens).In subtropical terai forest, on *Ficus* sp.; 400–1350m. Fl. March–July (throughout year); Fr. March.

GENERAL DISTRIBUTION. Nepal, India, Sri Lanka, Bangladesh, Myanmar, China (Yunnan), Thailand, Laos, Vietnam, Malaysia, Indonesia, the Philippines, Australia and the south-west Pacific Islands.
ETYMOLOGY. From the Latin *imbricatus* (overlapping) in reference to the rachis.
NOTE. De Vogel (1988) has reviewed the taxonomic confusion between this species and the closely related *P. pallida*.

6. **P. pallida** Lindl. in Bot. Reg. 21: sub t.1777 (1835). Neotype: Nepal, Gossainthan, *Wallich* s.n. (K-LINDL!), designated by Hallé in Flore de la Nouvelle-Calédonie et Dépendances 8: 254 (1977).
Pholidota calceata Rchb. f. in Bonplandia 4: 329 (1856). Type: India, Khasia, *Hooker* & *Thomson* 122 (holo. K-LINDL!).
Coelogyne calceata (Rchb. f.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 238 (1861).
Pholidota imbricata sensu Hook. f., Fl. Brit. India 5(2): 845 (1890), *non* Hook.
P. imbricata var. *sessilis* Hook. f., op. cit. 846 (1890). Type: India, Nagaland, Kohima, *Prain* (holo. K).
P. yunnanensis sensu Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 19: 378 (1924), *non* Rolfe
P. yunpeensis Hu in Rhodora 27: 107 (1925), *nom. nov.*
P. schlechteri Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 3: 147 (1931). Types: China, Yunnan, *Delavay* 4344 (syn. P); *Ducloux* 4573 (syn. P); *Ducloux* 6701 (syn. P); *Ducloux* 6940 (syn. P).
P. tixieri Guillaumin, op. cit. 28: 548 (1956). Type from Laos.
P. pallida var. *sessilis* (Hook. f.) Sarkar in J. Econ. Taxon. Bot. 5(5): 1008 (1984).

Plant epiphytic or lithophytic, 10–40cm tall. *Pseudobulbs* slender to swollen, sheathed, 2.5–6cm long; sheaths 5, rather inconspicuous, 3–8cm long. *Leaf* 1, oblong to linear-lanceolate, acute to acuminate, herbaceous, 6–30 × 1.5–6cm. *Inflorescence* synanthous, densely many-flowered; peduncle narrowly wiry, 5–18 × 0.03–0.1cm; rachis 5–11cm long; floral bracts ovate-sagittate, acute to obtuse, pubescent along margins, 0.5–0.7 × 0.6–1cm. *Flowers* membranous, fragrant, 5–6mm across, white or creamy-white, tinged with pink; pedicel and ovary 1.5–5.7 × 0.5–1.5mm. *Dorsal sepal* semi-elliptic to ovate, obtuse, forming a hood with the petals, 3–4.5 × 2–3.5mm; *lateral sepals* ovate to ovate-oblong, acute to apiculate, connate at base, 4–6 × 1.7–2.5mm. *Petals* weakly falcate, obtuse to acute, 3–5 × 0.7–2mm. *Lip* broadly 3-lobed, 3.7–5.5mm long (when spread); lateral lobes erect, broadly rounded; mid-lobe 2-lobed, lobes irregularly quadrate to semi-orbicular; disc with 3 short, wing-like keels at base. *Column* wide, wing-like, spathulate, 2–3.5 × 1.8–4mm. *Fruit* ellipsoid, 1–1.5 × 0.5–0.8cm.

Bhutan: S – Sarbhang district (19km above Sarbhang); C – Punakha (Bhotokha to Punakha, Rimchu, Tinlegang) and Mongar (E of Rudong La, Unjar) districts; N – Upper Mo Chu district (Mishichen to Tamji); **Darjeeling** (Kurseong); **Sikkim** (Gangtok). On rock face and hanging over cliff edges in hot mixed forest; 1000–2330m. Fl. May–August; Fr. October–December.

GENERAL DISTRIBUTION. Nepal, India, Myanmar, China (Yunnan), Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *pallidus* (pale) in reference to the flowers.

Section **Repentes** de Vogel in Orchid Monographs 3: 67 (1988).

7. **P. missionariorum** Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 3: 146 (1931). Types: China: Ganpin, *Martin* 2576 (lecto. P, designated by de Vogel in Orchid Monographs 3: 73 (1988); isolecto. E!); Kouy-tcheou, *Cavalerie* 3987 (syn. P).
Pholidota rupestris Handel-Mazzetti, Symb. Sin. 7: 1349 (1936). Type: China, Yunnan, *Handel-Mazzetti* 8801 (holo. W!).

Plant lithophytic or epiphytic, creeping, 8–10cm tall; *rhizome* slender; scales persistent. *Pseudobulbs* cylindric, swollen, shining, 1–1.8cm apart on rhizome, 0.6–2.5cm long. *Leaf* 1, ovate-oblong to linear-lanceolate, acute to acuminate, 2–6.5 × 0.4–1cm; petiole 0.1–1.1cm long. *Inflorescence* proteranthous or synanthous, 7- to 13-flowered; peduncle hidden, c.5mm long; rachis weakly zigzag, 2–4cm long; floral bracts ovate, acuminate, papery, 6–7 × 5–6mm. *Flowers* fragrant, white, greenish-white to cream-coloured; pedicel and ovary terete, 2.2–6 × 1–2mm. *Dorsal sepal* ovate, obtuse, 3.3–4.3 × 2–2.8cm; *lateral sepals* ovate to ovate-oblong, acute to acuminate, 3.8–4.7 × 1.8–2.2mm. *Petals* ovate, obtuse to acute, 3–3.5 × 1.7–2.5mm. Lip simple, broadly inserted, 3.5–4mm long; hypochile boat-shaped; epichile broadly rounded; disc with 3 short, low keels. Column hooded, 1.5–2mm long. Fruit ellipsoid, 0.8–1 × c.0.5cm.

Bhutan: C – Punakha district (Samtengang to Ritang). 1700–2400m. Fl./Fr. September–April.

GENERAL DISTRIBUTION. Myanmar and China.
ETYMOLOGY. A reference to Cavalerie and Martin, French missionaries working in China, who collected the type material for Gagnepain.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

354 **P. convallariae** (Rchb. f.) Hook. f. var. **breviscapa** Deori & Joseph in Bull. Bot. Surv. India 20: 159 (1979). Type: India, Arunachal Pradesh, Kameng, S.A. *Rao* 50902 (holo. CAL, iso. ASSAM).

NOTE. This variety was first described from Kameng in Arunachal Pradesh, but we have seen no material of it.

84. **Pleione** D. Don

Plants terrestrial, epiphytic or lithophytic, small. *Pseudobulbs* annual, clustered on rhizome, ovoid, conical, pyriform or barrel-shaped. *Leaves* 1 or 2, arising from apex of pseudobulb, deciduous, erect to curved-spreading, plicate, shortly petiolate. *Inflorescence* basal, erect, 1- or 2-flowered, appearing before or after leaves. *Flowers* showy, sometimes fragrant. *Sepals* and *petals* free, ± spreading. Lip obscurely 3-lobed to entire, apical margins erose to lacerate; callus of 2 to several lines of lamellae or hairs along veins of upper surface of lip. Column slender, slightly curved, winged above, entire, erose or denticulate at apex.

The genus *Pleione* was established in 1825 by David Don in his *Prodromus Florae Nepalensis*. The genus comprises about 16 species distributed from central Nepal, eastwards to NE India, Myanmar, China, Taiwan, Thailand and Laos.

Dressler (1993) recorded that cultivated species were often pollinated by bumble-bees which are, therefore, probably the pollinators in nature.

Cribb & Butterworth (1988, 1999) have monographed the genus.

LECTOTYPE. *Pleione praecox* (J.E. Smith) D. Don; basionym: *Epidendrum praecox* J.E. Smith.
ETYMOLOGY. From the Greek *Pleione*, the mythological mother of the Pleiades (a cluster of stars in the constellation Taurus, often referred to as 'the seven sisters').

Key to species

1.	Pseudobulbs with 2 leaves; autumn-flowering	2
+	Pseudobulbs with 1 leaf; spring-flowering	4
2.	Upper leaf attenuate	**5. P. saxicola**
+	Upper leaf not attenuate	3
3.	Peduncle sheaths inflated, smooth; sepals and petals white	**3. P. maculata**
+	Peduncle sheaths not inflated, warty; sepals and petals pink to pinkish-purple	**4. P. praecox**
4.	Lip not saccate at base; sepals and petals less than 3.5cm long; column 1.5–2.2cm long; plants stoloniferous; leaves synanthous	**1. P. hookeriana**
+	Lip saccate at base; sepals and petals more than 3.5cm long; column more than 2.6cm long; plants not stoloniferous; leaves hysteranthous	**2. P. humilis**

Section **Humiles** G. Zhu & S.C. Chen in Novon 8(4): 462 (1998).

1. **P. hookeriana** (Lindl.) B.S. Williams, Orch.-Grow. Man. ed.6: 548 (1885). Type: India, Sikkim/ Darjeeling, Hooker 74 (holo. K-LINDL!).

Coelogyne hookeriana Lindl., Fol. Orchid. Coelogyne 5: 14, no.37 (1854).

C. hookeriana var. *brachyglossa* Rchb. f. in Gard. Chron. ser.3, 1: 833 (1887). Type: India, Sikkim, cult. Lawrence (holo. W!).

Pleione hookeriana var. *brachyglossa* (Rchb. f.) Rolfe in Orchid Rev. 11: 291 (1903).

P. laotica Kerr in J. Siam Soc., Nat. Hist. Suppl. 9: 235 (1933). Type from Laos.

P. milanii Braem in Orchidées, Culture et protection 38: 23 (1999). Type: China, Yunnan, cult. Pinkepank (holo. SCHLE 98/10/6).

Plant epiphytic or lithophytic, small, 6–14cm tall. *Pseudobulbs* conical to ovoid, often clustered in large colonies, green or purple, often stoloniferous, 1–3 × 0.5–1.5cm. *Leaf* 1, elliptic-lanceolate to oblanceolate, acute, synanthous, 5–21 × 1–4.6cm; petiole 3–4cm long. *Inflorescence* 1-flowered, produced with the young leaf; peduncle slender, erect, 7–10.5cm long; floral bract ovate-elliptic, rounded at apex, 1–1.5 × 0.9–1.2cm. *Flower* 2–4cm across; sepals and petals lilac-pink to pink, rarely white, lip white with a yellow disc and lamellae, spotted with purple or yellowish-brown; pedicel and ovary 0.7–1.7cm long. *Dorsal sepal* oblong-lanceolate to oblanceolate, 2–3.2 × 0.6–0.9cm; *lateral sepals* falcate-lanceolate, 1.5–2.6 × c.1cm. *Petals* spreading, oblanceolate, acute, 2.5–3.5 × 0.5–0.7cm. *Lip* cordate to sub-reniform (when flattened), obscurely 3-lobed, emarginate, margins denticulate, 2–4 × 2.5–4cm; callus of 7 bearded lamellae. *Column* broadly winged above, dentate at apex, 1.5–2.2cm long. *Fruit* ellipsoid, long-stalked, 1.5–1.9 × 1.5–1.6cm. **Fig. 85**; **Plate 16.**

Bhutan: S – Chukka district (Gedu); **C** – Ha (Damthang, Sele La), Thimphu (below Barshong, Dotena, between Tsalimaphe and Hinglai La), Thimphu/Punakha (Dochu La), Punakha (Phobsikha, between Ritang and Pele La), Punakha/Tongsa (Pele La), Tongsa/Bumthang (below Yuto La) and Bumthang (Towli Phu) districts; **N** – Upper Bumthang Chu (Shimitang) and Upper Kulong Chu (Lao) districts; **Darjeeling** (Kalipokhri, Phalut, near Manibhanjan (field record), Senchal, Sandakphu, Tonglu); **Sikkim** (between Bakhim bungalow and Phedang, near Chiya Bhanjang, Lachen, Lachung, Lagyap CG); **Sikkim/Chumbi** (Yak La); **Chumbi** (Soo-li-la?). In mixed bamboo, *Rhododendron/Tsuga* forest, on *Acer* and *Juniperus* spp., on mossy rocks and trees, in shade; 2200–4200m. Fl. May–July.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand and Laos.

ETYMOLOGY. Named after Joseph Dalton Hooker (1817–1911) who collected the type specimen in Sikkim.

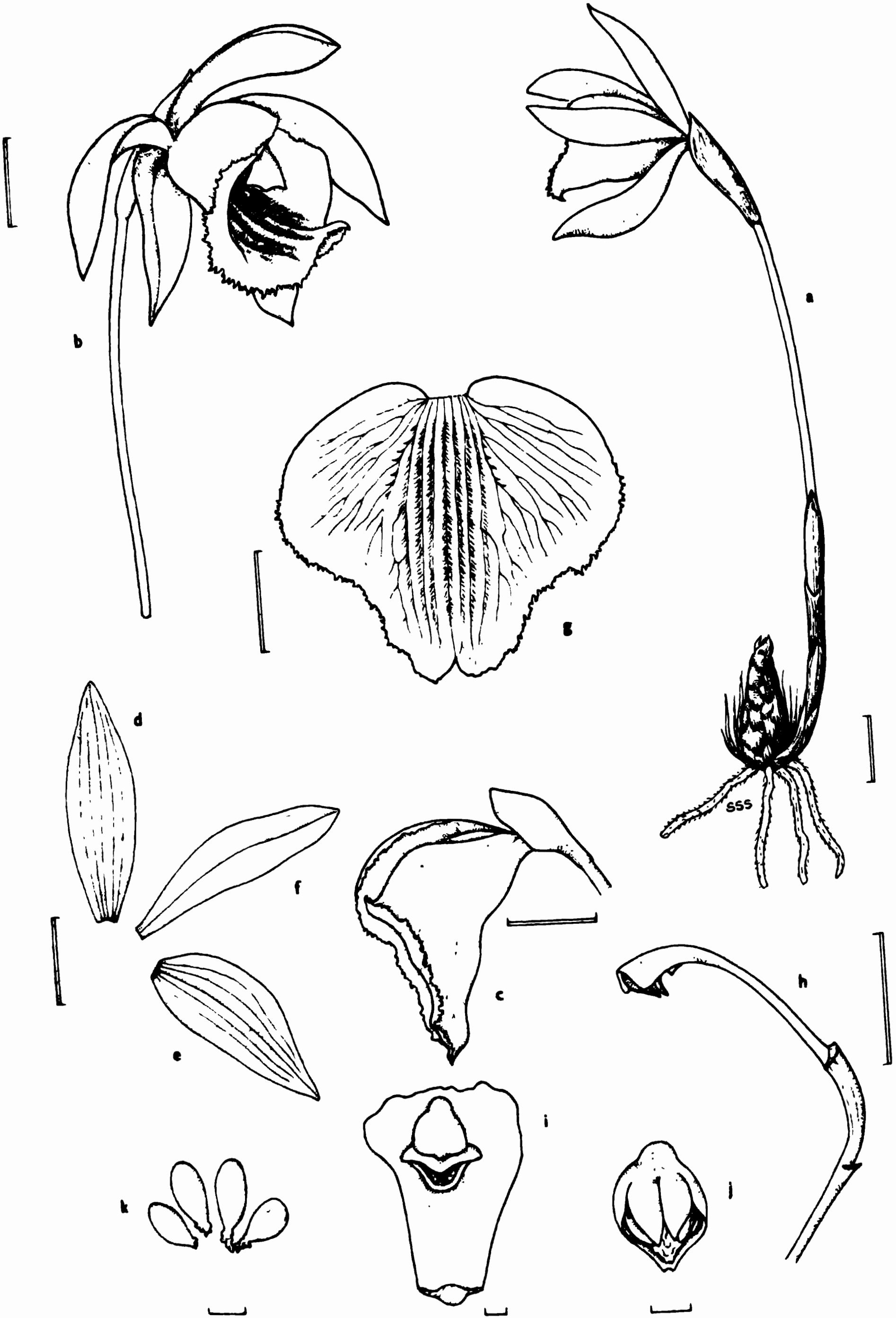


Fig. 85. **Pleione hookeriana**: a, habit; b, flower; c, lip, column and bract; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (side view); i, column apex; j, anther; k, pollinia. Drawn by Susanna Stuart-Smith, a from *Grierson & Long* 1724 (K); b–k from *Grey-Wilson et al.* 4564 (K).

NOTES. *P. hookeriana* is variable in flower colour, the sepals and petals ranging from white to pink. It is the only species to produce stolons. It is most closely related to *P. scopulorum* but that species is 2-leaved.

2. **P. humilis** (J.E. Smith) D. Don, Prodr. Fl. Nepal.: 37 (1825). Type: Nepal, based on icon. Buchanan-Hamilton (holo. LINN!, iso. British Library (India Office)!).

Epidendrum humile J.E. Smith, Exot. Bot. 2: 75, t.98 (1806).

Coelogyne humilis (J.E. Smith) Lindl., Coll. Bot.: sub t.37 (1821).

C. humilis var. *tricolor* Rchb. f. in Gard. Chron. n.s. 13: 394 (1880). Type without provenance.

C. humilis var. *albata* Rchb. f., *op. cit.* ser.3, 3: 392 (1888). Type without provenance.

Pleione humilis var. *adnata* Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 121 (1907). Type: India, Sikkim, *Pantling* 64 (holo. K!, iso. BM! W!).

P. humilis var. *purpurascens* Pfitzer, *op. cit.* 122 (1907). Type unknown.

P. diantha Schltr. in Orchis 9: 44 (1915). Type: Myanmar (Burma), cult. Hennis (holo. B†).

P. humilis var. *pulchella* E.W. Cooper in Roy. Hort. Soc., Dict. Gard. 3: 1606 (1951). Type unknown.

Plant epiphytic or lithophytic, 7–10cm tall (at flowering). *Pseudobulbs* flask-shaped, tapering to apex, olive-green, 2–6 × 0.8–2cm. *Leaf* 1, oblanceolate to elliptic, acute, produced after the flowers, 18–25 × 2.8–3.5cm. *Inflorescence* 1- or 2-flowered; peduncle enclosed by scarious sheaths; floral bract obovate, subacute to obtuse, 2–3.2 × 0.8–1.2cm. *Flowers* spreading to pendent; sepals and petals white, lip white spotted and streaked with crimson or yellow-brown, with a central pale yellow zone; pedicel and ovary 2–3cm long. *Dorsal sepal* linear-oblanceolate, subacute, 3.4–4.7 × 0.6–0.7cm; *lateral sepals* obliquely oblanceolate, 4–5.3 × 0.7–0.9cm. *Petals* obliquely oblanceolate, obtuse, 3.1–4.2 × 0.5–0.7cm. Lip oblong-elliptic, emarginate, saccate at base, obscurely 3-lobed in front, margin lacerate (in apical half), 3.4–4.4 × 2.5–3.5cm; lateral lobes erect-incurved; callus of 5–7 bearded lamellae. *Column* broadly winged, irregularly dentate at apex, 2.6–2.8cm long.

Bhutan: C – Thimphu/Punakha (Dochu La) and Punakha (Lamperi, Samtengang, Ritang) districts; **Darjeeling** (4km N of Manibhanjan (field record), Rungbool?, Senchal, Sonada); **Sikkim** (Rimbi Chhu, Tista–Rangit divide). On moss on trees, forming rings or collars around trunk, on moss-covered stones, in cloud forest; 1850–3200m. Fl. January–March.

GENERAL DISTRIBUTION. NE India, Nepal and Myanmar.

ETYMOLOGY. From the Latin humilis (low growing).

NOTE. *P. humilis* is the earliest of the spring-flowering species.

Section **Pleione**

[syn. *Dictyopleione* Pfitzer in Engler, Planzenr. (IV. 50): 125 (1907), *nom. inval.*]

3. **P. maculata** (Lindl.) Lindl. in Paxton's Fl. Gard. 2: 5, t.39 (1851). Type: Bangladesh, Pandua, coll. *F. De Silva* Wall. Cat. 1964 (holo. K-W!).

Coelogyne maculata Lindl., Gen. Sp. Orchid. Pl.: 43 (1830).

Pleione diphylla Lindl. in Paxton's Fl. Gard. 2: 66 (1851). Type: India, Khasia, *Griffith* 138 (holo. K!).

Coelogyne diphylla (Lindl.) Lindl., Fol. Orchid. Coelogyne 5: 15, no.38 (1854).

C. arthuriana Rchb. f. in Gard. Chron. n.s. 15: 40 (1881). Type without provenance.

C. maculata var. *virginea* Rchb. f., *op. cit.* ser.3, 2: 682 (1887). Type without provenance.

Gymnostylis candida Wall. ex Pfitzer in Engler, Pflanzenr. (IV.50) Coelog.: 127 (1907), *nom. nud.*

Pleione maculata var. *arthuriana* (Rchb. f.) Rolfe ex Kränzlin, *op. cit.* 128 (1907).

P. maculata var. *virginea* (Rchb. f.) S. Karthikeyan, Fl. Ind. Enumerat.-Monocot.: 166 (1989).

Plant epiphytic, 6–25cm tall. *Pseudobulbs* turbinate, beaked, covered by remains of old sheaths, 1–3 × 1–1.5cm. *Leaves* 2, apical from pseudobulb, elliptic-lanceolate to oblanceolate, acute, 10–25 ×

1.5–3.5cm. *Inflorescence* 1-flowered produced before the leaves; peduncle covered by inflated, smooth sheaths; floral bract suborbicular (when spread), hooded, obtuse, 1.7–3cm long. *Flowers* suberect to spreading, 4–6cm across, fragrant; sepals and petals white, occasionally lightly streaked with pink, lip white with a yellow centre and purple blotches on the apical margins, lamellae white; pedicel and ovary c.5mm long. *Dorsal sepal* oblong-lanceolate, obtuse, 3–4 × 0.6–0.8cm; *lateral sepals* broadly lanceolate-falcate, acute, 3–4 × 0.7–0.9cm. *Petals* oblanceolate, weakly falcate, 3–4.2 × 0.6–0.8cm. *Lip* 3-lobed, oblong, 2.5–3.5 × 2–2.5cm; lateral lobes obscure; mid-lobe emarginate, margin undulate-erose; callus of 5- to 7-papillose lines, extending to lip apex. *Column* erose-dentate at apex, 1.7–2cm long. *Fruit* ellipsoid, 1.8–2.5 × 0.6–1cm. **Plate 16.**

Bhutan: S – Phuntsholing (above Rinchending) and Chukka (Chima Kothi) districts; **Darjeeling** (Mongpu, Pedong, near Rambi Chhu); **Sikkim** (Linchyum, Lusing). On trees in subtropical forest; 600–1600m. Fl. October–November.

GENERAL DISTRIBUTION. NE India, SW China and Thailand.

ETYMOLOGY. From the Latin *maculatus* (spotted) in reference to the pattern on the lip.

NOTE. *P. maculata* and *P. praecox* are the only autumn-flowering species of *Pleione*.

4. **P. praecox** (J.E. Smith) D. Don, Prodr. Fl. Nepal.: 37 (1825). Type: Nepal, *Buchanan-Hamilton* s.n. (holo. LINN! Herb. no 1404.24.1, iso. BM!).

Epidendrum praecox J.E. Smith, Exot. Bot. 2: 73, t.97 (1806).

Coelogyne praecox (J.E. Smith) Lindl., Coll. Bot.: sub t.37 (1821).

C. praecox var. *sanguinea* Lindl., Fol. Orchid. Coelogyne 5: 16, no.42b (1854). Type: India, Sikkim, *Hooker* 73 (holo. K-LINDL!).

Pleione praecox var. *candida* Pfitzer, in Engler, Pflanzenr. (IV.50) Coelog.: 126 (1907). Type: India, Sikkim, *Pantling* 96A (holo. K!, iso. BM! W!).

Plant epiphytic or lithophytic, 10–30cm tall. *Pseudobulbs* turbinate, contracted above into a beak, green mottled with reddish-brown or purplish, 1.5–3 × 1–1.5cm. *Leaves* 1 or 2, elliptic-lanceolate to elliptic, acuminate, sheathed at base, 15–26 × 3–7cm; petiole 4–6cm long; sheath red-purple spotted. *Inflorescence* 1 (rarely 2)-flowered, produced after leaves have fallen; peduncle covered by c.3 warty sheaths; floral bract elliptic, acute, c.3 × 1.8cm. *Flowers* large and showy; white to pinkish-purple with yellow lamellae on the lip; pedicel and ovary c.1.5cm long. *Sepals* similar, narrowly oblong-lanceolate, acute, 5–7 × 0.8–1cm. *Petals* weakly falcate, linear-lanceolate, acute, 5–7 × 0.5–0.5cm. *Lip* elliptic, 3-lobed, 4–5 × c.3cm; mid-lobe emarginate, margins dentate-lacerate; callus of 3–5 papillose lines to middle of mid-lobe. *Column* slender, incurved and dentate at apex, 3.5–4.5cm long. *Fruit* long-ellipsoid, 2–4 × 0.6–0.9cm.

Bhutan: S – Chukka district (Chasilakha (M.F.B.), Marichong); C – Thimphu/Punakha (Dochu La), Punakha (Lamperi, Samtengang to Ritang, near Wangdi Phodrang (field record)), Tongsa (Dorji Gompa, Tashiling), Mongar (Khinay Lhakang to Unjar Chu) and Tashigang (Gamri Chu, Tashi Yangsi, between Nyoth and Tashi Yangtsi (M.F.B.), Yonpu La) districts; N – Upper Mo Chu (Tamji) and Upper Kulong Chu (near Tobrang (M.F.B.)) districts; **Darjeeling** (Kurseong, Phalut, Senchal, Sureil); **Sikkim** (5km NW of Gangtok (field record), Lusing, Rimbi Chhu). On moss-covered rock faces, in humus pockets, on *Rhododendron* and on ground in dense oak forest; 1200–3400m. Fl. September–November(–December).

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China and Thailand.

ETYMOLOGY. From the Latin *praecox* (precocious, developing early, bearing flowers before the leaves).

NOTE. A full synonymy of this variable species can be found in Cribb & Butterfield (1999).

5. P. saxicola T. Tang & F.T. Wang ex S.C. Chen in Acta Phytotax. Sin. 25(6): 473 (1987). Type: China, Yunnan, K.M. *Fang* 7914 (holo. PE!, iso. KUN!).

Plant terrestrial or lithophytic, 10–18cm tall. *Pseudobulbs* turbinate to ovoid, with a persistent short, apical annulus, 0.7–1.1 × 0.1–0.2cm. *Leaves* 1 or 2, suboblong, lanceolate or oblanceolate (upper when present often attenuate), acute to obtuse, 10–18 × 1.7–3.1cm; petiole 3–7cm long. *Inflorescence* 1-flowered; peduncle with warty bracts at base; floral bract oblanceolate, acute, 2–3 × c.1cm. *Flowers* not opening widely, 6–7cm long, uniformly pink; pedicel and ovary 1.4–1.7cm long. *Dorsal sepal* oblanceolate, acute, c.6.3 × 0.8cm; *lateral sepals* oblanceolate, acute to oblique, c.6.3 × 0.8cm. *Petals* oblanceolate, acute, c.6 × 0.6cm. *Lip* broadly elliptic in outline, 3-lobed at apex, wedge-shaped, clawed, 5.5 × 2.2–2.5cm; lateral lobes broadly ovate, margins irregularly crisped-crenulate, c.4–5mm wide; mid-lobe semi-orbicular, suborbicular at apex, margins irregularly crisped-crenulate, 0.8 × 1.5cm; callus of 3 parallel, entire, crisped lamellae, from disc centre to centre of mid-lobe, 1.6 × c.1mm (high). *Column* slender, dilated and narrowly winged at apex, 4–4.6cm long.

Bhutan: C – Sakden district (Mera Valley near Mera (Chambers, 1991)). 2360–2880m. Fl. September–October.

GENERAL DISTRIBUTION. China (SW Yunnan).
ETYMOLOGY. From the Latin *saxicolus* (rock-dwelling).
NOTES. Torelli & Riccaboni (1998) proposed a new classification for *Pleione*, treating sections *Dictyopleione* and *Pleione* as subgenera and introducing a separate subgenus for *P. saxicola*. *P. saxicola* frequently has 2 leaves, but has warty peduncle bracts typical of section *Dictyopleione* so we retain the established sectional treatment here.

Dendrobioid Subclade

Tribe **Podochileae** Pfitzer

Subtribe **Agrostophyllinae** Szlachetko

85. **Agrostophyllum** Bl.

Plants epiphytic. *Stems* clustered, lacking pseudobulbs, erect or pendent, bilaterally flattened, leafy, internodes numerous. *Leaves* distichous, narrow, thin, sheaths black to brown, overlapping. *Inflorescence* terminal, usually globose with flowers borne on an elongate axis, or paniculate. *Flowers* small, resupinate, numerous. *Sepals* and *petals* similar, free; lateral sepals forming a mentum which contains the saccate lip base. Lip entire to 3-lobed, saccate, base divided from the apex by a transverse partition. Column short to long; foot rudimentary; pollinia 8, attached to a solitary viscidium.

The genus *Agrostophyllum* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 50 species distributed from the Seychelles and tropical Asia to the Pacific Islands.

Schlechter (1911) revised the genus and proposed a sectional treatment, but all the N Indian species belong to section *Agrostophyllum*.

Dressler (1993) included *Agrostophyllum* in subtribe Glomerinae (tribe Epidendreae Kunth). He expressed some doubt about where exactly the genus should be placed as it has eight pollinia which should place it in the Podochilinae but its silica bodies are conical, rather than spherical. Szlachetko (1995) has established a new subtribe in the Podochileae and we follow his treatment here.

TYPE. *Agrostophyllum javanicum* Bl.
ETYMOLOGY. From the Greek *agrosto-* (grass) and *phyllon* (leaf) in reference to the grass-like leaves of many species.

Key to species

1. Stems caespitose; lip clawed, with a transverse ridge across the constriction; mentum spur-like; column foot absent .... **4. A. planicaule**
+ Stems spaced along rhizome; lip not clawed; mentum not spur-like; column foot present 2

2. Leaves 3 or 4, borne at apex of stem; column winged .... **1. A. brevipes**
+ Leaves more than 4, borne alternately along stem; column not winged 3

3. Flowers reddish-pink; callus on lip divided .... **2. A. callosum**
+ Flowers yellowish; callus on lip simple .... **3. A. myrianthum**

1. **A. brevipes** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 156, t.213 (1898). Type: India, Sikkim, *Pantling* 34 (holo. CAL, iso. AMES! BM! K! L! W!).
Agrostophyllum callosum sensu Hook. f., Fl. Brit. India 5(2): 824 *p.p.* (1890), non Rchb. f.

Plant 16–40cm tall; *rhizome* slender, c.3mm thick, covered by linear scales. *Stems* 2.5–3cm apart on rhizome, 7–17.5cm tall, covered with overlapping sheaths; sheaths lanceolate, acute, 1–3.5cm long (elongating up the stem). *Leaves* 3 or 4, arising from apex of stem, alternate, linear-oblong, apex emarginate, subacute, margins entire, base sessile, sheathing, 5.5–16 × 0.2–0.9cm. *Inflorescence* globose, surrounded by leaf bases, densely many-flowered, 1–1.5cm long; floral bracts clustered and overlapping at base of inflorescence, lanceolate to ovate-lanceolate, acute, 5–7 × 1–2mm. *Flowers* 3–4mm across; sepals, petals and lip white, column and anther dark crimson (*vide* King & Pantling, 1898); pedicel and ovary c.5mm long. *Sepals* subsimilar, lanceolate-ovate, acute, c.3 × 1.5mm (at base). *Petals* suborbicular to ovate, acute, c.3 × 1.5mm. *Lip* 3-lobed, oblong, concave, not spurred, c.3mm long; lateral lobes broad, rounded; mid-lobe oblong, emarginate, smooth; disc with a central callus and 2 smaller, conical, boss-like calluses below. *Column* short, shortly winged at apex; foot short; clinandrium dentate. *Fruit* narrowly ellipsoid (not seen).

Bhutan: S – Chukka district (Chasilakha (M.F.B.)); **Sikkim** (Gangtok). In tropical valleys; 1500m. Fl. (December–)May–June.

GENERAL DISTRIBUTION. NE India, Thailand and Laos.
ETYMOLOGY. From the Latin *brevis* (short) and *pes* (foot) in reference to the column foot.

2. **A. callosum** Rchb. f. in Seeman, Fl. Vit.: 296 (1868). Type: India, Sikkim, *Hooker* 201 (holo. K-LINDL!).

Plant 20–45cm tall; *rhizome* sheathed, stout, branched, bearing shoots 1–4cm apart. *Stems* wider at apex than base, covered in overlapping sheaths; sheaths cylindric, 1–2.5cm long. *Leaves* many up stem, alternate, linear-oblong, tapering gradually to emarginate apex, sessile and sheathing at base, 5.5–18 × 0.5–0.9cm. *Inflorescence* capitate-globose, densely many-flowered, 2.5–3cm across; floral bracts spathe-like, subacute, membranous, 4–6 × 2.5–3mm. *Flowers* 3–5mm long; sepals, petals and lip reddish-pink, column deeper purple, pollinia yellow; pedicel and ovary 8–9mm long. *Sepals* similar, ovate, obtuse, c.3 × 1.5mm. *Petals* broadly elliptic, obtuse, c.3 × 1.5cm. *Lip* 3-lobed; lateral lobes broadly rounded; mid-lobe decurved, reniform, emarginate; disc with large basal callus, dividing into 2 diverging, cylindric lobes, apex thickened. *Column* stout, lacking wings, c.1mm long; foot short. *Fruits* densely clustered, ellipsoid, 7–9 × 3–4mm. **Fig. 86.**

Bhutan: S – Chukka district (Chukka Dzong); C – Punakha (Lometsawa) and Tashigang (near Tashi Yangtsi (M.F.B.)) districts; (unlocalised *Griffith* specimen); **Darjeeling** (Great Rangit River, Takdah); **Sikkim** (Chongpung, between Singhik and Gangtok, Rathang Chhu Valley between Mintok Khola and Paha Khola, Tendong). Common, in mixed, broad-leaved forest; 660–2300m. Fl. (February–)April–July.

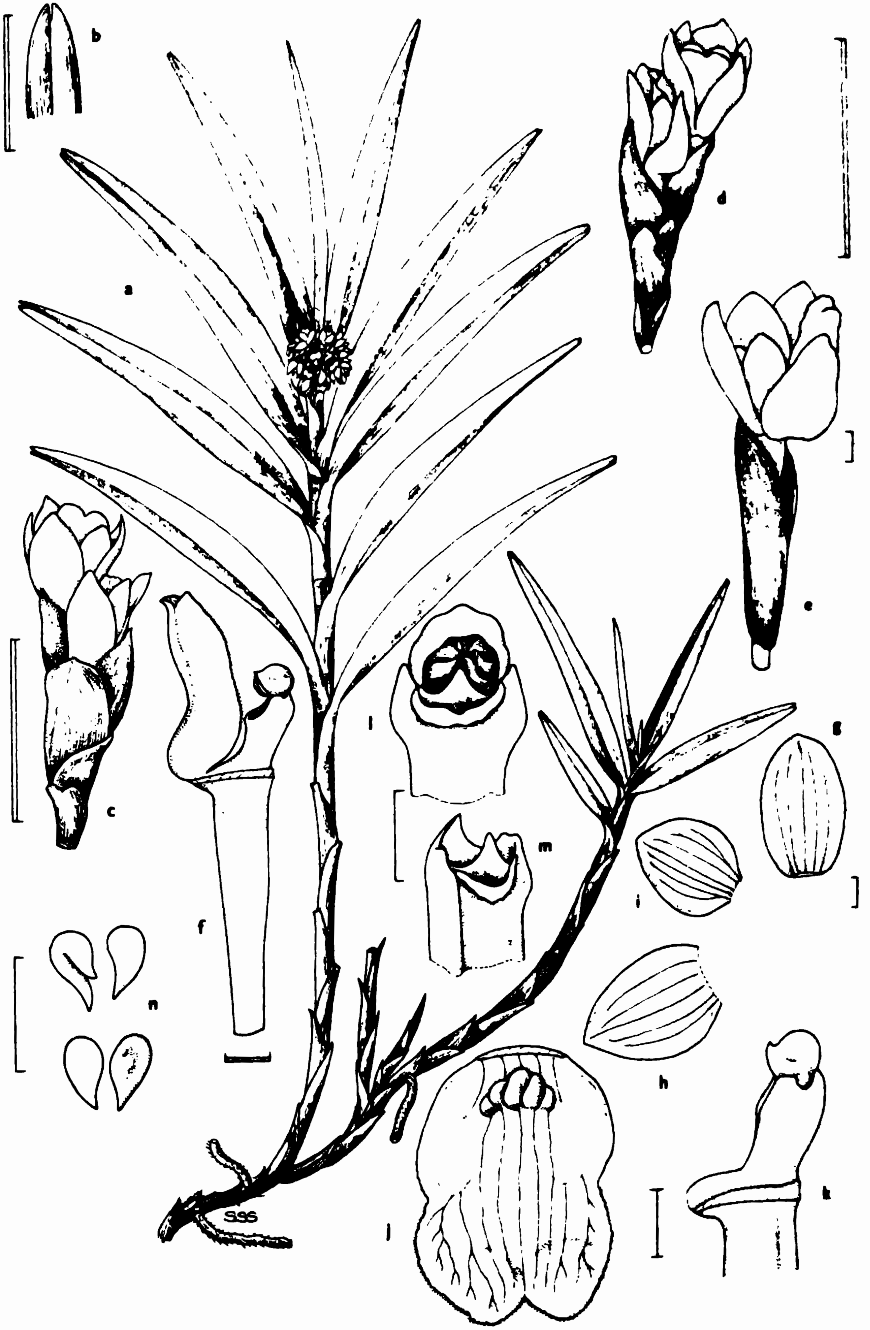


Fig. 86. **Agrostophyllum callosum**: a, habit; b, leaf apex (detail); c–d, inflorescence; e, flower with bract; f, lip, column and ovary; g, dorsal sepal; h, lateral sepal; i, petal; j, lip; k, column (side view); l, column apex; m, column apex (with anther removed); n, pollinia. Drawn by Susanna Stuart-Smith, a–b from *Pentling* 477 (K); c–n from *Trudel* 902 (K).

GENERAL DISTRIBUTION. Nepal, NE India, China (Yunnan) and Thailand.
ETYMOLOGY. From the Latin *callosus* (a hard swelling) in reference to the large basal callus on the lip.
NOTES. *A. callosum* is closely related to *A. brevipes* and *A. myrianthum*, both described by King & Pantling. *A. brevipes* is a smaller plant with usually no more than three leaves, a winged column and is found at lower altitudes. Seidenfaden (1986) considered that the two species were vegetatively quite distinct. *A. myrianthum*, however, is very similar to *A. callosum* but has a simple (rather than divided) callus. The only specimens seen of this species are the Pantling collections from Sikkim. The lip has an undivided callus but is otherwise very similar. Further collections are required to resolve this problem.

3. **A. myrianthum** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 155, t.211 (1898). Type: India, Sikkim, Teesta (Tista), *Pantling* 459 (holo. K!, iso. BM!).

Plant 35–40cm tall; *rhizome* stout, woody, covered with appressed, lanceolate scales. *Stems* 3–4cm apart on rhizome, widening from base to apex, covered with overlapping sheaths. *Leaves* alternate, linear-oblong, prominently 1-veined abaxially, emarginate to apex, obtuse, base sessile, sheathing, 9–13 × 0.7–1cm. *Inflorescence* globose, densely many-flowered, c.2.8cm across; floral bracts narrowly ovate, acute, 4–5 × 1–2mm. *Flowers* c.3mm across, yellowish; pedicel and ovary c.0.9–1cm long. *Sepals* similar, ovate-orbicular, obtuse, concave, 2–3 × c.1mm. *Petals* oblong-ovate, obtuse, 2–3 × c.1mm. *Lip* 3-lobed, oblong, c.3mm long; lateral lobes rounded; mid-lobe broadly ovate, entire to emarginate; disc with a single, large, central callus. *Column* unwinged, c.1mm long; foot short.

Sikkim (Tista River). Fl. August.

GENERAL DISTRIBUTION. NE India (Arunachal Pradesh).
ETYMOLOGY. From the Greek *myrio-* (numerous) and *anthos* (flower).

4. **A. planicaule** (Wall. ex Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 909 (1864). Type: NE India, *Wallich* (holo. based on icon. by Booth, flowered at Carclew, 1839, K-LINDL!).
Eria planicaulis Wall. ex Lindl. in Bot. Reg. 26: 8, misc.8, no.4 (1840).
Agrostophyllum khasianum Griff. in Calcutta J. Nat. Hist. 4: 376, t.19 (1844). Type: India, Khasia, *Gibson* (holo. CAL).
Appendicula hasseltii sensu Wight, Icon. Pl. Ind. Orient. 5: 20 (1852), non Bl.
Agrostophyllum hasseltii sensu (Wight) Rchb. f.. in Walpers, Ann. Bot. Syst. 6: 909 (1864), non (Bl.) J.J. Smith.

Plant 20–40cm tall; *roots* caespitose, numerous. *Stems* fusiform, compressed, covered by overlapping sheaths; sheaths ovate, acuminate, deep brown, 1–3cm (at base) to 7–8cm at apex. *Leaves* 3 or 4, arising from apex of stem, distichous, alternate, narrowly ovate-oblong, tapering to each end, obtuse to minutely emarginate, shortly petiolate, thickly membranous, erect, deep, shining green, 7–19 × 1.5–2.3cm; petiole grooved, sheathing at base, 1–3.5cm long. *Inflorescence* globose-capitate, c.2cm across, densely many-flowered; peduncle short; floral bracts fibrous-membranous, lanceolate, subacute, brown, 6–7 × 1.5–2.5mm. *Flowers* 3–4mm across; sepals, petals and lip cream-white, with patches of pale yellow on mid-lobe of lip, mentum and column ochre; pedicel and ovary 6–8mm long. *Sepals* subsimilar, ovate-oblong, acute to acuminate, c.2.5 × 1.5mm; lateral sepals suboblique. *Petals* narrowly linear-oblong, acute, margins recurved, c.2 × 1.2mm. *Lip* simple, clawed, c.2.5mm long; base saccate, ridged at constriction; apical lobe broad, transversely oblong to reniform, minutely emarginate at apex, margins undulate; mentum spur-like. *Column* broad, lacking a foot, with 2 fleshy, horn-like projections at base, c.1mm long. *Fruits* clustered, ellipsoid, 4–7mm long.

Sikkim (unlocalised King and Pantling specimens). In tropical valleys. Fl. August.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar to SE Asia.
ETYMOLOGY. From the Latin *planus* (flat) and *caulis* (stem).

Subtribe Eriinae Bentham

86. Ceratostylis Bl.

Plants epiphytic; roots fibrous. Stems simple or branched, caespitose, 1-leaved, ± terete and rush-like, with thin, brown, reticulate basal sheaths. *Leaves* narrow, coriaceous, fleshy to subterete, rarely thin. *Flowers* resupinate, small (rarely larger and showy), solitary to few within a small cluster of bracts. *Sepals* erect, connivent; lateral sepals forming a saccate or spur-like mentum with the column foot. *Petals* narrow. Lip adnate to column foot by a long, incumbent claw, entire, usually with longitudinal calluses. Column short, dilated above, 2-lobed or with 2 spathulate, erect arms; foot long; pollinia 8, sessile.

The genus *Ceratostylis* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 100 species distributed from India and SE Asia to Indonesia and New Guinea.

TYPE. *non designatus*.
ETYMOLOGY. From the Greek *cerato-* (a horn) and *stylis* (style) in reference to the usually fleshy column that may have a horn-like appearance.

Key to species

1. Stems branched; column undivided .... **1. C. himalaica**
+ Stems unbranched, rush-like; column deeply divided .... **2. C. subulata**

1. C. himalaica Hook. f., Fl. Brit. India 5(2): 826 (1890). Types: E Nepal, *Hooker* 359 (syn. K-LINDL!, isosyn. K!); Bhutan, *Griffith* s.n. (syn. K-LINDL!, isosyn. K!); India, Khasia Hills, *Gibson* s.n. (syn. CAL).
Eria ramosissima Wall. ex Hook. f., Fl. Brit. India 5(2): 826 (1890), nom. nud.
Ritaia himalaica (Hook. f.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 157, t.214 (1898).

Plant 6–19cm tall. *Stems* pendent, dichotomously branched, covered by overlapping, scarious sheaths; branches short, each bearing a single leaf and a single, terminal peduncle, 2–3.5cm long; sheaths ovate-lanceolate, subacute, strongly veined, 0.7–1.2cm long. *Leaf* fleshy, linear-oblong, apex obliquely notched, acute, shortly petiolate, 4–6 × 0.2–0.5cm; petiole 3–4mm. *Inflorescence* arising from leaf base, subcapitate, 1- or 2-flowered, c.5 × 5mm; peduncle with 2 sheaths; floral bract ovate, acute to acuminate, sheathing, 4–5 × 1.5–2mm. *Flowers* pubescent externally, c.4mm across; sepals and petals pale greenish-yellow, lip bright yellow; pedicel and ovary pubescent. *Dorsal sepal* ovate-lanceolate, concave, subacute, c.3mm long; *lateral sepals* similar, broadly ovate-lanceolate, acuminate, incurved, connate at base to form a mentum. *Petals* spreading, linear, acute, c.3mm long. *Lip* unlobed, fleshy, suborbicular, emarginate, 3–4mm long. *Column* very short; foot short. *Fruit* ellipsoid, 5–7 × 3–4mm. **Fig. 87; Plate 16.**

Bhutan: C – Punakha district (Lometsawa, Ngawang); **Sikkim** (unlocalised *Pantling* specimen). On *Quercus griffithii*; 1700–1900m. Fl. June.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Himalayas where the species was originally found.

2. C. subulata Bl., Bijdr.: 306 (1825). Type: Java, Salak, Pantjar, *Blume* s.n. (holo. L! *sine loc.* Herb. no. 902322884).
Appendicula teres Griff., Not. Pl. Asiat. 3: 359 (1851). Type: India, Upper Assam, Negrigam, *Griffith* s.n. (holo. K-LINDL!).
Ceratostylis teres (Griff.) Rchb. f. in Bonplandia 2: 89 (1854).
C. cepula Rchb. f., op. cit. 5: 53 (1857). Type from Java.
C. gracilis sensu Rchb. f., Xenia Orchid. 2: 92 (1863), non Bl.
C. malaccensis Hook. f., Fl. Brit. India 5(2): 825 (1890). Type from Malaysia.

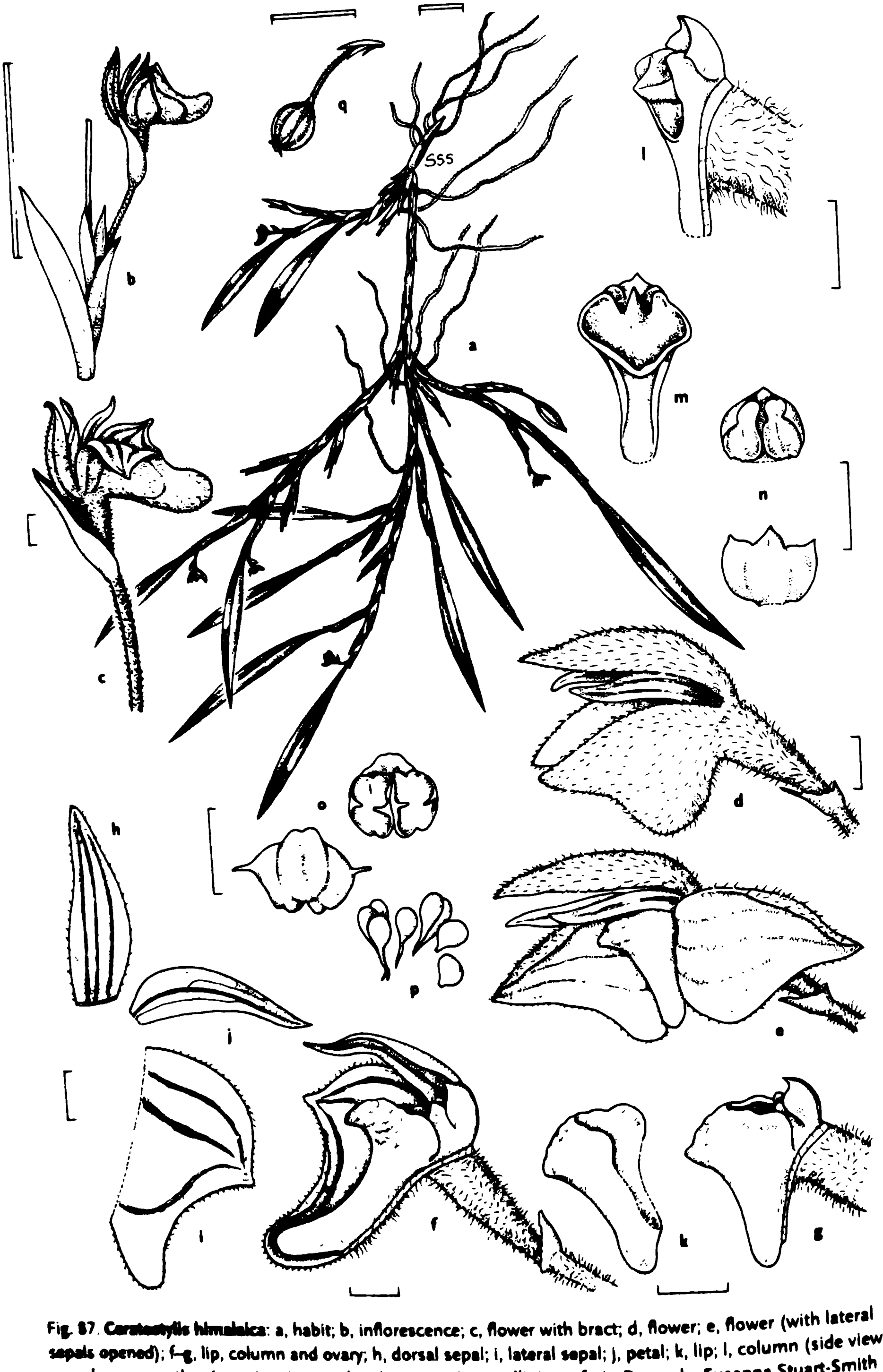


Fig. 87. **Ceratostylis himalaica**: a, habit; b, inflorescence; c, flower with bract; d, flower; e, flower (with lateral sepals opened); f–g, lip, column and ovary; h, dorsal sepal; i, lateral sepal; j, petal; k, lip; l, column (side view); m, column; n, anther (two views); o, anther (two views); p, pollinia; q, fruit. Drawn by Susanna Stuart-Smith a–c, f, h–j, o, q from *Kingdon-Ward* 8100; d–e, g, k–n, p from *Pantling* 149 (K).

Plant 17–35cm tall; *roots* clustered; *rhizome* fibrous. *Stems* closely tufted, rush-like, sheathed at base, dark green, 7–30 × 0.1–0.3cm; basal sheaths overlapping, lanceolate, acute, 1.5–3 × c.0.5cm. *Leaf* 1, linear, subterete, grooved on one side, arising from stem apex, overtopping inflorescence, 1.2–2.7 × 0.2–0.4cm. *Inflorescence* terminal, capitate, sessile, dense, 3–5mm long; peduncle sheaths broadly lanceolate, subacute, scarious, 2–3 × 1.5–2mm; floral bracts small, scarious, 2.5–3mm long. *Flowers* not opening widely, sparsely pubescent, sepals and petals yellow or dull red-purple, lip yellow, white at base; pedicel and ovary puberulent, c.1.5mm long. *Dorsal sepal* ovate-lanceolate, subacute, apex recurved, spreading, c.3 × 1mm; *lateral sepals* similar, connate to form a pubescent mentum. *Petals* oblong-lanceolate, acute, c.2 × 1mm. *Lip* simple, spathulate, narrow at base, rounded to obtuse at apex, c.3.5 × 1.5mm; disc with 2 raised ridges from base to apex; *mentum* c.1.5mm long. *Column* short, deeply 2-lobed; stelidia short, broad; foot long. *Fruit* ellipsoid, curved, 3–7mm long.

Sikkim (unlocalised *Pantling* specimen). In tropical valleys. Fl. May–June.

GENERAL DISTRIBUTION. NE India, China, SE Asia to Malaysia, Sumatra, Java, Borneo and the Philippines.

ETYMOLOGY. From the Latin *subulatus* (linear) in reference to the shape of the leaves.

NOTES. We have examined the type material of *C. teres* and compared it with collections of *C. subulata* from Malaysia and find them to be virtually identical. Most recent authors (Jain & Mehrotra, 1984; Averyanov 1988b, 1994; Seidenfaden, 1992) have treated *C. teres* as conspecific with the widespread and variable *C. subulata*. We follow this treatment here, but note Seidenfaden's reservations and it is possible that *C. teres* is a distinct, northern entity distributed from Sikkim to Hainan.

87. **Cryptochilus** Wall.

Plants epiphytic or lithophytic. *Pseudobulbs* clustered. *Leaves* arising from apex of pseudobulb, coriaceous, petiolate. *Inflorescence* terminal, racemose, secund; floral bracts exceeding flowers. *Sepals* connate to form a subcylindric to urceolate tube, apices free, acute. *Petals* similar, not connate. *Lip* simple, adnate to the short column foot. *Column* erect, slightly dilated at apex; pollinia 8.

The genus *Cryptochilus* was described in 1826 by Nathaniel Wallich in his *Tentamen Florae Nepalensis Illustratae*. The genus comprises two (possibly three, Seidenfaden, 1992) species distributed from N India to Indo-China.

TYPE. *Cryptochilus sanguinea* Wall.

ETYMOLOGY. From the Greek *krypto-* (hidden) and *cheilos* (lip) in reference to the fact that the lip is hidden by the urceolate sepals and petals.

Key to species

1. Sepaline tube yellow; pollinia yellow .... **1. C. lutea**

+ Sepaline tube scarlet; pollinia green .... **2. C. sanguinea**

1. C. lutea Lindl. in J. Proc. Linn. Soc., Bot. 3: 21 (1858). Types: India, Mishmee Hills, *Griffith* s.n. (syn. K-LINDL!); Darjeeling, *Griffith* s.n. (syn. K-LINDL!).

Cryptochilus farreri Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 20: 384 (1924). Type: China, Xizang, *Farrer* 1649 (holo. B).

Plant 14–22cm tall. *Pseudobulbs* clustered, cylindric, covered by overlapping sheaths, 2–2.5 × 0.4–0.9cm. *Leaves* 2, narrowly elliptic, acute, fleshy, 6.5–17 × 1–2.2cm; petiole 2–6cm long. *Inflorescence* subdensely many-flowered; peduncle glabrous, slender, 7–14cm long; rachis 3.5–8cm long; floral bracts alternate, prominent, linear-lanceolate, acute, 6–9mm long. *Flowers* in 2 ranks, 3–5mm long, yellow; pedicel and ovary pubescent, c.5mm long. *Sepals* similar, connate, forming an urceolate sepaline tube, apices triangular-acute, free, 4–5mm long. *Petals* narrowly, obliquely rhombic, narrowed at base,

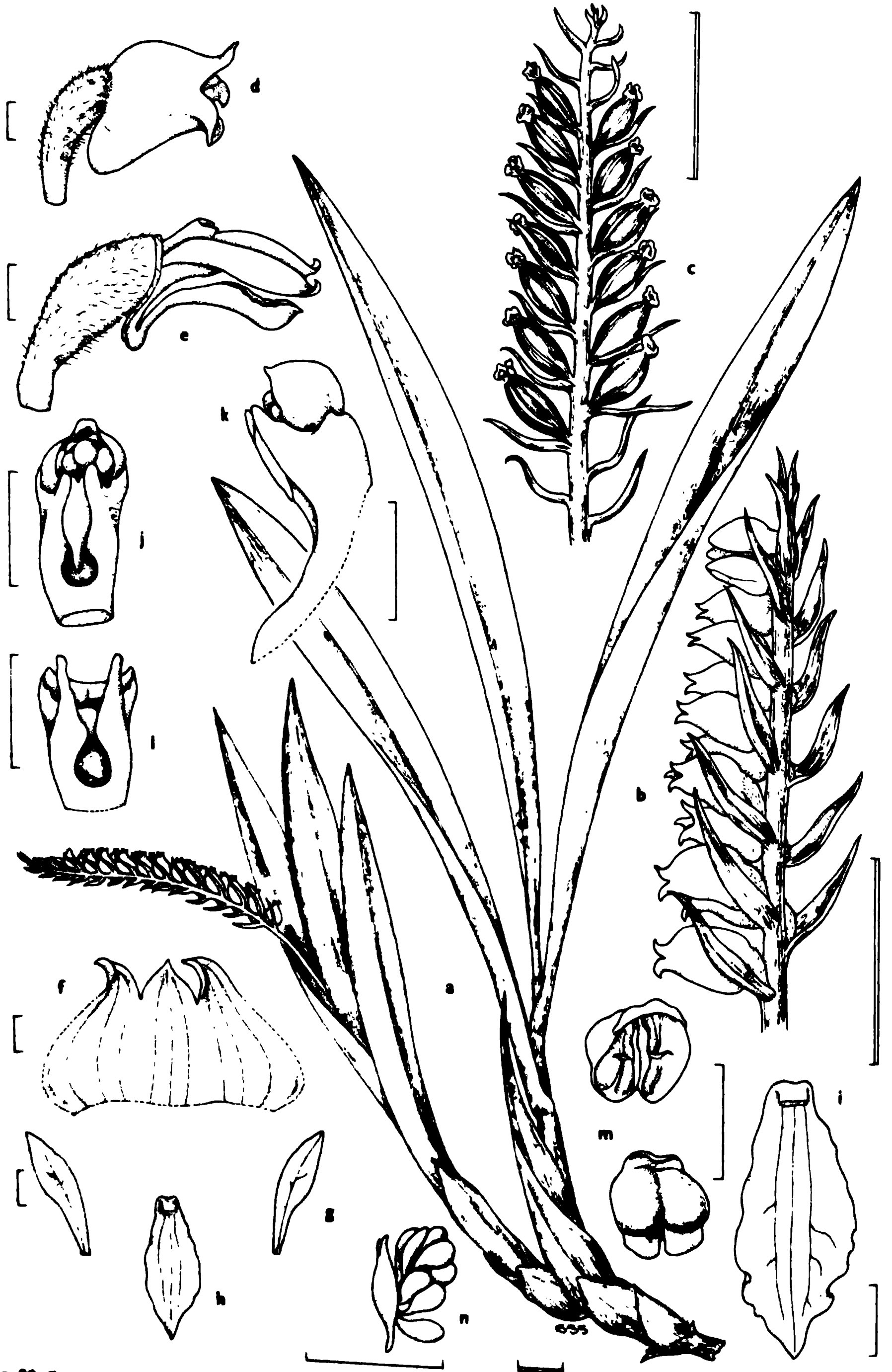


Fig. 88. **Cryptochilus lutea**: a, habit; b, inflorescence; c, infructescence; d, flower; e, lip, column and ovary; f, dorsal sepal and petals; g, lateral sepals; h–i, lip; j, column; k, column (side view); l, column (with anther removed); m, anther (two views); n, pollinarium. Drawn by Susanna Stuart-Smith, a and c from *Grierson & Long* 2240 (E); b, d–n from *Gould* 667 (K).

c.4mm long. *Lip* simple, oblong, expanded, curved at base, grooved and thickened towards apex, 3–4mm long. *Column* short, clavate, apex bifid; foot narrow, 2–3mm long. *Fruit* ellipsoid, suberect, 3–5mm long. **Fig. 88; Plate 16.**

Bhutan: S – Deothang district (11km S of Riserboo, N of Samdrup Jongkhar); **C** – Punakha (near Wangdi Phodrang), Tongsa (Changkha to Chendebi) and Tashigang (Tashi Yangtsi (M.F.B.)) districts; **Darjeeling** (Budhwari); **Sikkim** (unlocalised *Gammie* and *Pantling* specimens). On rock face by road in warm broad-leaved forest, on trees; 1660–2500m. Fl. June–August.

GENERAL DISTRIBUTION. N India, Myanmar (possibly to Indo-China).
ETYMOLOGY. From the Latin *luteus* (yellow) in reference to the flower colour.
NOTES. Seidenfaden (1992) discussed the synonymy of this species but remained uncertain as to the exact position of the Indo-Chinese species *C. ctenostachya* Gagnepain. Averyanov (1994) treated it, and the closely related *C. petelotii* Gagnepain, as species distinct from *C. lutea*.

2. C. sanguinea Wall., Tent. Fl. Nepal 2: 36, t.26 (1826). Types: Nepal, Chandaghiry (Kandrang Garhi), *Wallich* s.n. (syn. CAL possibly lost); ?India, Mt. Sillet, coll. *W. Gomez* Wall. Cat. 7350 (syn. K-LINDL!, isosyn. K-W!).

Plant 16–30cm tall. *Pseudobulbs* ovoid to ellipsoid-cylindric, sheathed at base, green, 2.5–4.5 × 0.6–1.2cm. *Leaves* 2, oblong to elliptic, acute to acuminate, coriaceous, bright green, 12–21 × 2–4.3cm; petiole 4–5cm long. *Inflorescence* subdensely 7- to 19-flowered; peduncle glabrous, 9.5–19cm long; rachis glabrous, 4–9cm long; floral bracts alternate, linear-lanceolate, acuminate, erect, 0.7–1.7 × 0.2–0.3cm. *Flowers* in 2 ranks, pubescent externally, 1–1.5cm long; sepaline tube scarlet with purple apices, petals, lip and column yellow; pedicel and ovary densely white-pubescent, 3–4 × 1.5–2mm. *Sepals* connate to form a gibbous sepaline tube, free apices triangular, divergent, acute, puberulous externally, 1–1.5cm long. *Petals* oblanceolate-spathulate, obtuse, c.1cm long. *Lip* simple, oblong, entire, deflexed from a curved base, expanded slightly at apex, c.1cm long. *Column* stout, puberulous distally, c.5mm long; foot short. *Fruit* ellipsoid-ovoid, erect, 0.5–1.2cm long.

Bhutan: C – Tashigang district (near Tashi Yangtsi (M.F.B.)); **Darjeeling** (Great Rangit River); **Sikkim** (Rathang Chhu Valley, Rimbi Chhu, between Yoksam and Paha Khola). On moss-covered tree in broad-leaved forest; 1940–2330m. Fl. June–July.

GENERAL DISTRIBUTION. Nepal, NE India, and Myanmar.
ETYMOLOGY. From the Latin *sanguineus* (blood-red) in reference to the flower colour.

88. Eria Lindl.

Plants epiphytic, or rarely terrestrial, of variable habit. *Stems* pseudobulbous, or cane-like with (1–)2 to many leaves. *Leaves* flat or terete, thin-textured or coriaceous. *Inflorescence* terminal or axillary, racemose or rarely 1-flowered. *Flowers* small to medium in size, often inconspicuous (rarely showy); rachis often hirsute or woolly. *Sepals* free (rarely connate), glabrous or hirsute; lateral sepals adnate to the elongate column foot to form a short to long, spur-like or gibbous mentum. *Lip* sessile on column foot and incumbent (rarely mobile). *Column* short, broad, often 2-winged, foot prominent; anther imperfectly 4-loculed; pollinia 8, waxy, pyriform or broadly ovoid, attached in 4s, by narrow bases, to a viscidium.

The genus *Eria* was established in 1825 by John Lindley in the *Botanical Register*. The genus comprises about 370 species, widespread in tropical Asia, extending east to New Guinea, Australia and the Pacific Islands. Seidenfaden (1982) revised the Thai species and a fuller synonymy of the widespread species can be found there.

Møller & Rasmussen (1984) studied stegmata (silica bodies) in the Orchidales. They found considerable heterogeneity in the Podochilinae but in the subtribe Eriinae they are usually spherical.

Dressler & Cook (1988) found that *E. javanica* had conical stegmata and also differed from other members of Eriinae in having plicate leaves. Plicate leaves are considered ancestral and, in addition to the conical stegmata, imply that the genus as it currently stands is polyphyletic. This presents considerable problems with the delimitation of *Eria*. Anderson *et al.* (1988) have studied vegetative characters in *Eria* and find that they do not support the concept of *Eria* s.l. as a monophyletic group. Hashimoto & Tanaka (1983) studied the karyomorphology of some *Eria* species and found that the sectional delimitation of *Hymenaria*, *Pinalia* and *Strongyleria*, as currently accepted, are probably untenable. The genus is in need of a complete revision.

Many species of *Eria* have pseudopollen on the lip and are probably pollinated by small bees (Dressler, 1993).

TYPE. *Eria stellata* Lindl. typ. cons.
ETYMOLOGY. From the Greek *erio-* (wool) in reference to the outside of the perianth.

Key to species

1. Stems or pseudobulbs consisting of 1 distinct internode 2
+ Stems or pseudobulbs consisting of several internodes 10

2. Leaves plicate .... **1. E. javanica**
+ Leaves conduplicate 3

3. Plants less than 4cm tall; pseudobulbs less than 1cm tall ...... **2. E. muscicola** var. **muscicola**
+ Plants more than 4cm tall; pseudobulbs more than 1cm tall 4

4. Plants with 1 leaf .... **3. E. carinata**
+ Plants with 2 or more leaves 5

5. Lip simple .... **6. E. vittata**
+ Lip 3-lobed 6

6. Pseudobulbs narrowly cylindric, more than 4cm tall 7
+ Pseudobulbs conical, ovoid or flask-shaped, less than 3cm tall 8

7. Flowers more than 2cm long; pseudobulbs 5–18cm tall, always 2-leaved; flowering October to January .... **5. E. coronaria**
+ Flowers less than 1.3cm long; pseudobulbs 4–9cm tall, 2- to 6-leaved; flowering in April **18. E. bractescens**

8. Rachis glabrous; lip with 5–7 sinuous lamellae; pseudobulbs always 2-leaved ...... **4. E. clausa**
+ Rachis pubescent or reddish-pubescent; lip with 2 lamellae or 2 variable calluses at base; pseudobulbs 2- to 6-leaved 9

9. Floral bracts less than 5mm long; rachis pubescent; ovary less than 6mm long; lip with 2 ridges .... **16. E. alba**
+ Floral bracts more than 5mm long; rachis reddish-pubescent; ovary more than 6mm long; lip with 2 variable calluses at base .... **19. E. excavata**

10. Plants reed-like; more than 30cm tall; stems more than 7-leaved 11
+ Plants pseudobulbous; less than 30cm tall; stems less than 7-leaved 12

11. Leaves terete to flat, less than 1cm wide; inflorescence densely many-flowered **11. E. paniculata**
+ Leaves narrowly elliptic-oblong, more than 2cm wide; inflorescence laxly few-flowered **14. E. bambusifolia**

12. Leaves terete, less than 4mm wide .... **7. E. pannea**
+ Leaves flat, more than 4mm wide 13

13. Inflorescence globose-capitate, 0.4–1cm across 14
+ Inflorescence not as above 15

14. Lateral sepals connate to form a tubular mentum; lateral lobes of lip narrow ... **21. E. connata**
+ Lateral sepals not forming a tubular mentum; lateral lobes of lip lanceolate-acuminate **22. E. pumila**

15. Inflorescence secund (or in 2 opposite ranks); flowers white-woolly; peduncle glabrous **12. E.stricta**
+ Inflorescence not as above 16

16. Inforescence glabrous throughout (apart from ovary) 17
+ Inflorescence woolly, tomentose or pubescent 18

17. Inflorescence less than 1cm long; 2- or 3-flowered .... **13. E. biflora**
+ Inflorescence more than 2cm long; densely many-flowered .... **23. E. spicata**

18. Inflorescence densely or softly tomentose 19
+ Inflorescence pubescent, not tomentose 21

19. Inflorescence lateral from pseudobulb apex (below leaf) .... **8. E. discolor**
+ Inflorescence lateral from pseudobulb base 20

20. Inflorescence rusty- to olive-tomentose; flowers more than 2cm across .... **9. E. ferruginea**
+ Inflorescence white-tomentose; flowers less than 2cm across .... **10. E. lasiopetala**

21. Pseudobulbs long-cylindric; sepals and petals pure white .... **20. E. graminifolia**
+ Pseudobulbs flask-like, stacked; sepals and petals tinged with green or yellow 22

22. Sepals and petals white tinged with green; leaf apex obtuse, emarginate .... **15. E. acervata**
+ Sepals and petals buff-yellow to greenish-yellow; leaf apex acute .... **17. E. amica**

Section **Eria**

1. E. javanica (Sw.) Bl., Rumphia 2: 23 (1836). Type: E Java, *Thunberg* s.n. (holo. UPS, not located).

Dendrobium javanicum Sw. in Kongl. Vetensk.. Acad. Nya. Handl. 21: 247 (1800).

Eria fragrans Rchb. f.. in Bot. Zeitung (Berlin) 22: 415 (1864). Type: Myanmar (Burma), Moulmein, cult. Low (holo. W).

Dendrobium perakense Hook. f., Fl. Brit. India 5(2): 712 (1890). Type from Malaysia

Pinalia fragrans (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Sarcopodium perakense (Hook. f.) Kränzlin in Engler, Pflanzenr. (IV.50) Dendrob.: 328 (1910).

Katherinea perakense (Hook. f.) A.D. Hawkes in Lloydia 19: 97 (1956).

Plant epiphytic, sympodial, 16–35cm tall; *rhizome* stout, covered with fibrous sheaths, internodes 3–6cm. *Pseudobulbs* erect, ovoid-ellipsoid, compressed, bearing leaves and bladeless sheaths, 5–7 × 1–1.5cm. *Leaves* 2, erect, elliptic-oblong, acuminate, shortly petiolate, many-veined, plicate, coriaceous, 11–25 × 2–4.5cm; petiole grooved, jointed, 1–2.5cm long. *Inflorescence* arising from apex of pseudobulb, erect to suberect, laxly 10- to 16-flowered; peduncle 2–9cm long; rachis puberulent, 15–32cm long; floral bracts lanceolate, acute, pubescent, 0.9–1.5 × 0.2–0.4cm. *Flowers* facing in all directions, sweetly fragrant, c.4cm wide, white to pale yellowish, purple-veined; pedicel and ovary pubescent, 5–8mm long. *Sepals* subsimilar, lanceolate, acuminate, spreading, reflexed at apex, pubescent externally, 1.8–2.8 × 0.4–0.5cm; lateral sepals connate to form a short, rounded, incurved mentum. *Petals* lanceolate, acute to acuminate, falcate, glabrous, spreading, 1.3–1.5 × 0.3–0.5cm. Lip hinged to the column foot, 3-lobed, 1.2–1.5cm long; lateral lobes erect, short, auriculate, weakly falcate, obtuse; mid-lobe narrowly oblong, deflexed at the middle, apex acute; disc with 5 narrow, crisped ridges. Column broad, 4–6mm long.

Sikkim (unlocalised *Pantling* specimen). In tropical valleys. Fl. July–August.

GENERAL DISTRIBUTION. NE India, Myanmar, SE Asia, Malaysia, Indonesia, New Guinea and the Philippines.

ETYMOLOGY. From Java, where the species was first found.

NOTE. We have searched for the type material of this species with the help of Roland Moberg (UPS), Bertil Nordenstam (S) and U.-M. Hiltgård (SBT) but it cannot be found in these herbaria. If further searches fail, then a neotype will have to be selected.

Section **Conchidium** Lindl. in J. Proc. Linn. Soc., Bot. 3: 46 (1859).

2. **E. muscicola** (Lindl.) Lindl. in J. Proc. Linn. Soc., Bot. 3: 47 (1859). Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 2017 (holo. K-LINDL!, iso. K-W! K!).

Dendrobium parviflorum D. Don, Prodr. Fl. Nepal.: 34 (1825). Type: Nepal, Gossainthan, *Wallich* s.n. (holo. BM, lost).

D. muscicola Lindl., Gen. Sp. Orchid. Pl.: 75 (1830).

Pinalia muscicola (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Conchidium muscicola (Lindl.) Rauschert in Feddes Repert. 94(7–8): 444 (1983).

var. **muscicola**

Plant epiphytic, 2.5–4cm tall. *Pseudobulbs* caespitose, depressed-globose, reticulate, 5–6 × 4–6mm. *Stem* short, slender. *Leaves* 2–4, oblanceolate, apiculate, shortly petiolate, jointed at base, 1–2 × 0.3–0.4cm; petiole 6–8mm; section below articulation 4–5mm long. *Inflorescence* terminal, erect, racemose, secund, 3- to 6-flowered; peduncle glabrous, sheathed, 1.8–2.2cm long; sheaths 1 or 2, ovate-lanceolate, acute, c.2 × 0.8mm; rachis glabrous, 0.5–1cm long; floral bracts lanceolate, acuminate, 4–5 × 1–1.5mm. *Flowers* 3–4mm long, pale green; pedicel and ovary c.2mm long. *Sepals* subequal, lanceolate, acuminate, spreading, 2.5–4.2 × 0.8–1mm; *lateral sepals* falcate. *Petals* linear-lanceolate, spreading, 2–2.5 × 0.6–0.9mm. Lip simple, lanceolate, concave, dilated and deflexed at the middle, 2.6 × 0.9–1.2mm; apex minutely 3-lobed, margins erose in apical third only; disc 2-callose at base. *Column* c.1.5mm long; foot curved, c.1.2mm long.

Bhutan: C – Tashigang district (near Tashi Yangtsi (M.F.B.)); **Darjeeling** (Pedong); **Sikkim** (Namchi, Singtam). 1330–3000m. Fl. July–August.

GENERAL DISTRIBUTION. N India, Nepal, Myanmar, China to SE Asia (? extending to Sri Lanka).

ETYMOLOGY. From the Latin *muscus* (moss) and *-cola* (dwelling), a reference to the plant's habitat.

NOTES. There remains some doubt as to whether *Pantling* 163 at K represents var. *muscicola* or var. *oblonga*, and until this uncertainty has been resolved we treat them as conspecific. A discussion of var. *oblonga* Trimen (described from Sri Lanka) is given below under 'doubtful and imperfectly known species'.

There is a specimen at BM (Darjeeling, Phelong, *Clarke* 9587) that is related to var. *muscicola*, but which flowers in October. Unfortunately, there are no flowers on the specimen and we are uncertain of its identity. Ormerod (2000) discussed the synonymy of some species in *Eria*, including *E. muscicola*.

Section **Xiphosium** Lindl. in J. Proc. Linn. Soc., Bot. 3: 50 (1859).

3. **E. carinata** Gibson ex Lindl. in J. Proc. Linn. Soc., Bot. 3: 50 (1859). Type: India, Khasia Hills, Churra Punjee, *Griffith* 5121 (holo. K-LINDL!, iso. K!).

Xiphosium acuminatum Griff. in Calcutta J. Nat. Hist. 5: 365, t.25 (1845), *nom. alt.*

Eria fordii Rolfe in Gard. Chron. n.s. 26: 584 (1886). Type: China, Hong Kong, *Ford* (holo. K-LINDL!).

Pinalia carinata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant epiphytic, 15–30cm tall; *rhizome* creeping, covered by overlapping, scaly sheaths. *Pseudobulbs* cylindric-ovoid, compressed, obscurely 4-sided, scurfy, 3–7 × 1–2.5cm. *Leaf* 1, oblong-lanceolate, acute, petiolate, coriaceous, jointed at base, 13–23 × 2.6–4.2cm; petiole grooved, 2–7cm long. *Inflorescence* basal from pseudobulb, erect, 3- to 5-flowered; peduncle concealed by overlapping sheaths, 8–15cm long; sheaths 4 or 5, lanceolate, acute, 2.2–8 × 1–1.8cm; rachis 4–7cm long; floral bracts linear, acuminate, spreading, 2.5–4.5 × 0.2–0.3cm. *Flowers* gaping, c.2cm long; sepals and petals brownish-red with red veins, green at base and on keel, lip maroon with a pink to tawny-yellow central area and red veins, column white; pedicel and ovary c.1cm long. *Sepals* subsimilar, oblong-lanceolate, acuminate, keeled, 1.5–2.2 × 0.3–0.5cm; *lateral sepals* oblique, adnate with the column foot to form a gibbous mentum. *Petals* ovate-lanceolate, acuminate, 1.1–1.8 × 0.4–0.5cm. *Lip* obscurely 3-lobed, jointed with the column foot, 1.4–1.7 × 0.5–0.6cm; lateral lobes small, round, erect; mid-lobe broadly rounded to sublanceolate, apiculate, reflexed in the centre. *Column* curved, 3-toothed at apex, c.1.5cm long.

Bhutan: C – Punakha (Rimchu to Khosa) and Mongar (3km E of Mongar Dzong (M.F.B.)) districts; **Sikkim** (unlocalised *Pantling* specimen). 660–1400m. Fl. November–January.

GENERAL DISTRIBUTION. NE India and Thailand.

ETYMOLOGY. From the Latin *carinatus* (keeled) in reference to the sepals.

NOTES. Griffith originally described this species as *Xiphosium acuminatum*, commenting that the plant had flowered in Calcutta and been given the name *Eria carinata* by Gibson. This latter name was not, however, validly published until 1859. The name *E. acuminata* had already been used by Lindley for a different species, so Griffith's epithet was not available for transfer.

Section **Trichosma** Lindl. in J. Proc. Linn. Soc., Bot. 3: 52 (1859).

4. **E. clausa** King & Pantling in J. Asiat. Soc. Bengal 65(2): 121 (1896). Type: India, Darjeeling, Sitong Point, *Pantling* 359 (holo. CAL, iso. K!).

Eria corneri var. *clausa* (King & Pantling) A.N. Rao in J. Econ. Taxon. Bot. 20(3): 708 (1996).

Plant epiphytic, 4–17cm tall; *rhizome* c.2mm thick. *Pseudobulbs* ovoid-ellipsoid, blunt at apex, with a single node, bases clothed in fibrous sheaths, rugose when dry, 1.5–3cm tall. *Leaves* 2, arising from pseudobulb apex, elliptic-lanceolate, acute to acuminate, petiolate, membranous, 4–12 × 1.4–2.4cm; petiole grooved, 0.8–2cm long. *Inflorescence* 1 (occasionally 2), arising from pseudobulb apex, racemose, laxly 5- to 9-flowered; peduncle sheathed, glabrous, 1.5–2.5cm long; sheaths lanceolate, acute, membranous, 1.5–2.5cm long rachis weakly zigzag, glabrous, 1.5–4cm long; floral bracts obscure, reduced to ring-like swellings at base of ovary, c.0.5mm tall. *Flowers* c.5mm long, pale greenish with brown streaks (on lip only); pedicel and ovary c.1cm long. *Sepals* similar, oblong-lanceolate, obtuse to subacute, 6–7mm long. *Petals* oblong, obtuse, weakly falcate, 5–6mm long. Lip 3-lobed, c.5mm long; lateral lobes rounded, oblique; mid-lobe short, entire; disc with 5–7 sinuous lamellae from base to apex, outer ones reduced. Column c.3mm long. Fruit 5–9 × 2–3mm. **Fig. 89.**

Bhutan: C – Punakha district (Punakha to Tinlegang); **Darjeeling** (Sitong Point). 1600–2000m. Fl. February–May.

GENERAL DISTRIBUTION. NE India, Myanmar, China (Yunnan) and Vietnam.

ETYMOLOGY. From the Latin *clausus* (closed).

NOTES. *E. clausa* is closely related to *E. boniana* (Gagnepain) T. Tang & F.T. Wang and to *E. corneri* Rchb. f. Tang & Wang (1951), Lang & Tsi (1976) and Seidenfaden (1992) treated them as distinct species. Averyanov (1994) treated *E. clausa* as a synonym of *E. corneri*. King & Pantling (1898) suggested that *E. clausa* might be a cleistogamous form of *E. vittata*, whereas Rao (1996b) suggested that it was a cleistogamous form of *E. corneri*. From the material we have examined it is clear that they differ in that *E. corneri* has clustered pseudobulbs, while *E. clausa* has well spaced pseudobulbs. Pending further study of living material, we follow the position of Seidenfaden.

5. **E. coronaria** (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 271 (1864). Type: India, Khasia Hills, *J. Gibson* s.n. (holo. K-LINDL!).

Coelogyne coronaria Lindl. in Bot. Reg. 27: 83, misc.83, no.178 (1841).

Trichosma suavis Lindl., op. cit. 28: t.21 (1842), nom. alt.

Eria cylindropoda Griff., Not. Pl. Asiat. 3: 299, 404 (1851); Icon. Pl. Asiat. 3: t.351A (1851). Type: India, Khasia, *Griffith* 231 (holo. K!).

Dendrobium crepidatum sensu Griff., op. cit. 319 (1851), nom. illeg., non Lindl (1850).

Eria suavis (Lindl.) Lindl. in J. Proc. Linn. Soc., Bot. 3: 52 (1859).

Trichosma coronaria (Lindl.) Kuntze, Revis. Gen. Pl. 2: 681 (1891).

Plant epiphytic, 12–38cm tall. *Pseudobulbs* cylindric, slender, tufted, with a single node, sheathed at base, 5–18 × 0.2–0.4cm; sheaths tubular, fibrous, 3–6cm long. *Leaves* 2, arising from pseudobulb apex, elliptic to ovate-lanceolate, acute, jointed, many-veined, subsessile, grooved, subopposite, thickly membranous, 8.5–18 × 2.3–4.8cm. *Inflorescence* arising from pseudobulb apex, erect to arching, 4- to 6-flowered; peduncle short, sheathed at base; sheath lanceolate, acute, c.2 × 0.5cm; rachis glabrous, 2–3cm long; floral bracts narrowly lanceolate, short, 2–5mm long. *Flowers* 2–2.5cm long, white to pale purple, lip flushed with purple, lateral lobes striped with purple, mid-lobe yellow with purple dots; pedicel and ovary glabrous, 1.4–1.6cm long. *Sepals* spreading, glabrous, 1.7–2.1 × 0.6–0.7cm; *dorsal sepal* elliptic-oblong, subacute; *lateral sepals* adnate to the column foot to form a mentum. *Petals* elliptic-oblong, acute, glabrous, 1.6–1.9 × 0.5–0.9cm. Lip 3-lobed, oblong, 1–1.6 × 1–1.3cm; lateral lobes large, rounded; mid-lobe small, oblong, revolute, margins undulate; disc with 2 broad, undulate ridges extending into the mid-lobe and 6–7 undulate, crenate ridges within the mid-lobe. Column stout, 5–6mm long; foot tapering, short. Fruit ellipsoid, slightly dilated towards apex, 2–2.5 × 0.7–0.9cm. **Plate 17.**

Bhutan: C – Punakha (Khelekha, Nobding, Ritang (F.E.H.2), near Talo (field record), Tashi Choling (F.E.H.2)), Tongsa (Shemgang (M.F.B.), Tashiling (F.E.H.2)) and Tashigang (Yonpu La) districts; **Darjeeling** (Birch Hill, Dumsong, Kurseong, Sureil); **Sikkim** (Chakung, Gangtok, Lusing, N side of Penlang La, Rimbi Chhu). On trees and rocky banks; 1160–2300m. Fl. October–January; Fr. April.

GENERAL DISTRIBUTION. N India, Nepal, China, Thailand and Vietnam.

ETYMOLOGY. From the Latin *coronarius* (forming a crown).

NOTE. Chen & Tsi (1987) described *E. medongensis* a peloric species closely related to *E. coronaria* from the Mêdong region of SE Xijang.

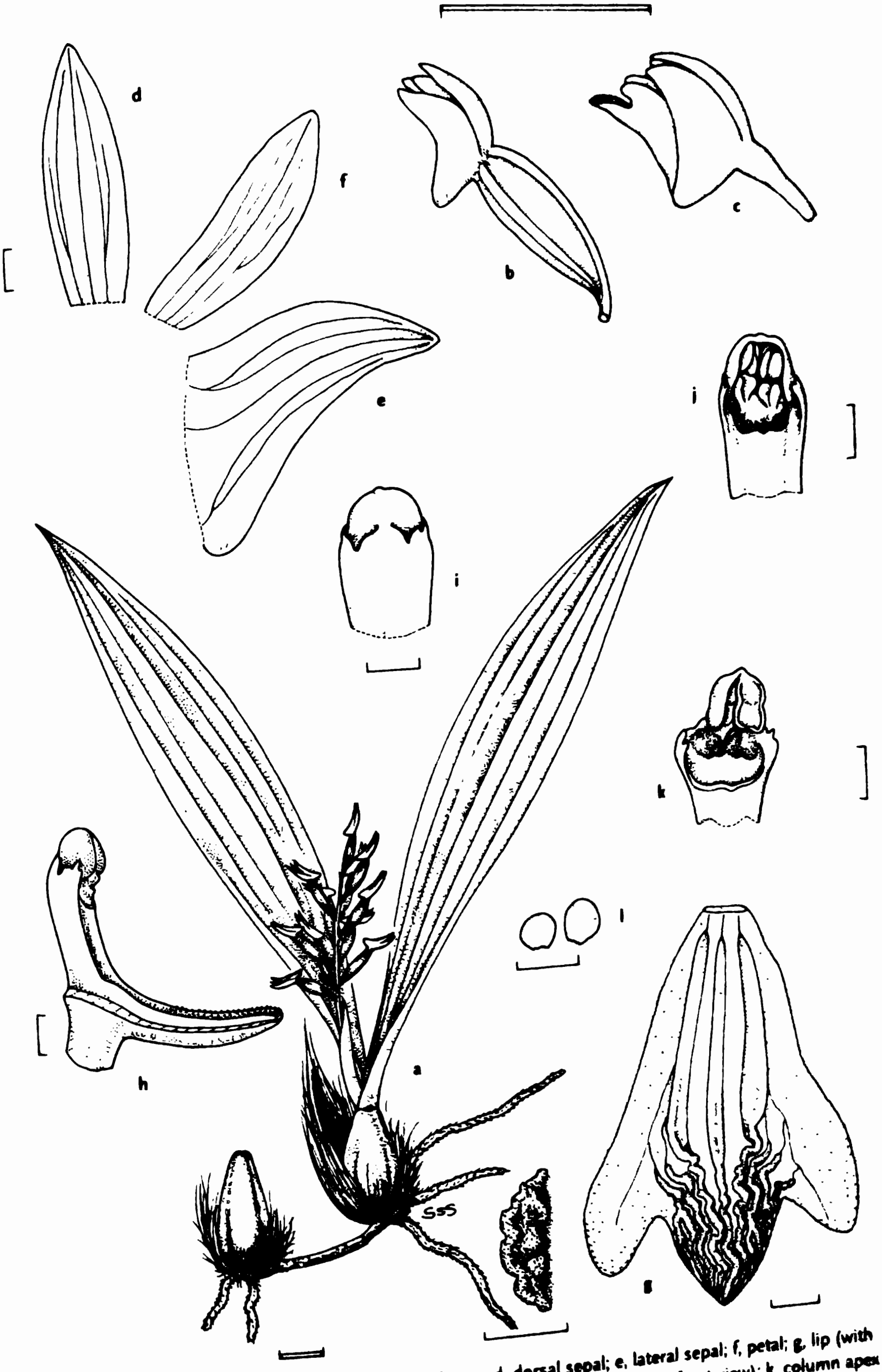


Fig. 89. **Eria clausa**: a, habit; b, flower with ovary; c, flower; d, dorsal sepal; e, lateral sepal; f, petal; g, lip (with detail of ridge); h, column (side view); i, column apex (back view); j, column apex (front view); k, column apex (showing self pollination); l, pollinia. Drawn by Susanna Stuart-Smith, a–b and k from *Pantling* 359 (K); c–j and l from *Bullock* 955 (K).

6. **E. vittata** Lindl. in J. Proc. Linn. Soc., Bot. 3: 51 (1859). Type: India, Sikkim, icon. Cathcart s.n. (holo. K!).

Pinalia vittata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant epiphytic, 11–27cm tall; *rhizome* stout, sheathed. *Pseudobulbs* distant or clustered, ovoid-conical to cylindric, sheathed, 3–6 × 0.6–1cm; sheaths unequal, brown, 2–3 × 1–1.5cm. *Leaves* 2, elliptic-lanceolate, acute to acuminate, tapering to petiolate base, membranous, many-veined, 7–17 × 1.5–4cm; petiole 0.8–3cm long. *Inflorescence* racemose, arising from pseudobulb apex, decurved, densely many-flowered; peduncle glabrous, sheathing at base; sheaths lanceolate, acute, 1–2cm long; rachis 6–8cm long; floral bracts minute, triangular, persistent, 0.5–0.8 × 0.2–0.3mm. *Flowers* strongly fragrant, glabrous, 1.4–1.7cm long, pale green, sepals and petals strongly striped purple-red, lip lamellae red-pink; pedicel and ovary 1cm long. *Dorsal sepal* oblong, subacute, 5-veined, 0.8–1.2 × 0.15–0.2cm; *lateral sepals* triangular-oblong, spreading, 5-veined, connate at base to form a mentum, 0.6–1.1 × 0.7–1cm; *mentum* c.7mm deep. *Petals* narrowly oblong, weakly falcate, obtuse to subtruncate, 3-veined, c.6 × 1.5mm. *Lip* simple, broadly elliptic-oblong in outline, decurved, margins crenulate towards apex, attached to base of column foot, 1–1.1 × 0.4–0.5cm; disc with 5 crenulate lamellae from base to apex. *Column* slender, curved, 5–9mm long; foot purple, 7–9mm long; rostellum elongate, cylindric, red; pollinia yellow, c.0.5mm wide.

Darjeeling (unlocalised cultivated specimen); **Sikkim** (Chhokha, Yoksam). In woodland in light shade; 1660–2743m. Fl. January–March.

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. From the Latin *vittatus* (striped) in reference to the sepals and petals.

Section **Strongyleria** Pfitzer in Engler, Nat. Pflanzenfam. 2: 175 (1888).

374 7. **E. pannea** Lindl. in Bot. Reg. 28: misc.64, no.79 (1842). Type: Singapore, cult. Loddiges 252 (holo. ?K-LINDL!).

Eria teretifolia Griff., Itin. Pl. Khasyah Mts.: 202 (1848). Types: Bhutan, Marichong, *Griffith* 12 (syn. K-LINDL!); Bhutan, *Grifith* 1185 (syn. K-LINDL!).

E. calamifolia Hook. f., Fl. Brit. India 6(1): 191 (1890). Type: India, Assam, *Mann* 72 (holo. K!).

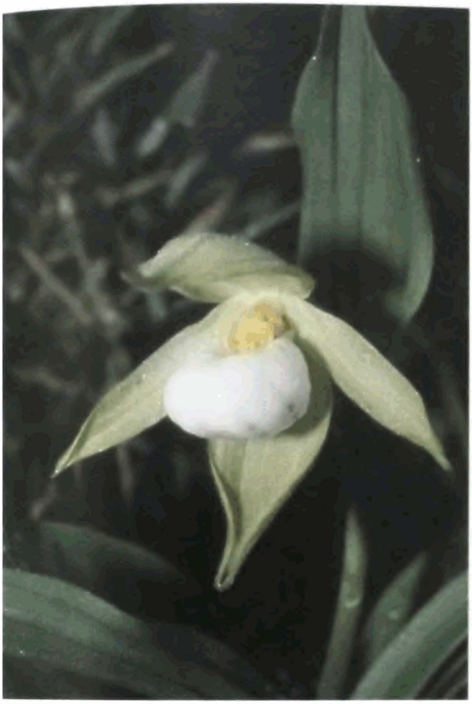
Pinalia calamifolia (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

P. pannea (Lindl.) Kuntze, *loc. cit.* (1891).

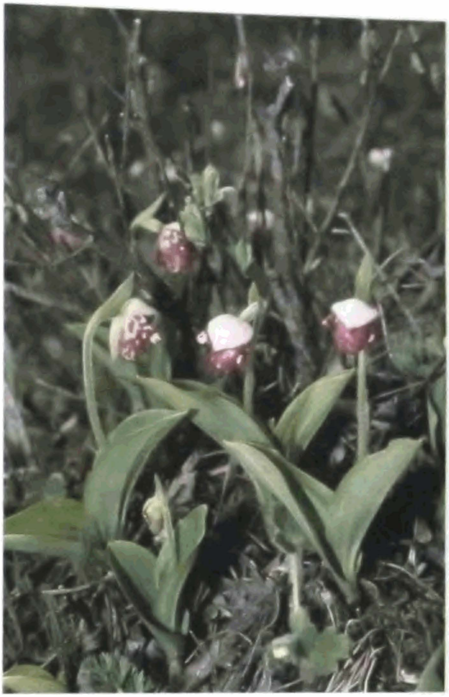
Plant epiphytic or lithophytic, 13–25cm tall; *rhizome* slender, partly covered with white-hairy sheaths, internodes 3–5cm. *Leaves* 2–6, linear, laterally flattened, fleshy, subterete, 3.5–19 × 0.2–0.4cm. *Inflorescence* arising from between leaves, 1- to 5-flowered; peduncle woolly, 1–3cm long; rachis weakly zigzag, densely woolly, 2–3cm long; floral bracts lanceolate-ovate, acute, woolly externally, 5–6 × 3–4mm. *Flowers* vanilla-fragrant, 1–2cm wide, pale yellow-green, lip dark purplish, yellow within; pedicel and ovary pubescent, 4–5mm long. *Sepals* similar, elliptic-lanceolate to ovate-triangular, acute, densely white-woolly externally, 5–9 × 2–5mm; *lateral sepals* weakly falcate; *mentum* curved, obtuse. *Petals* lanceolate-elliptic, 3–4 × 2–3mm. *Lip* simple, fleshy, ovate-oblong, obtuse, with a patch of white-mealy hairiness near apex, margins weakly undulate, 5–8mm long; basal callus oblong-granular. *Column* pubescent externally, 1–2mm long; foot curved. *Fruit* cylindric, ridged, 1.3–1.5 × 0.4–0.6cm.

Bhutan: S – Chukka district (near Chukka, Marichong); **C** – Punakha district (Samadingkha); **Sikkim** (above Rongnek Chhu, below Gangtok, Shagyoun). In tropical valleys, on sun-baked rocks; 1000–1330m. Fl. May–July; Fr. November.

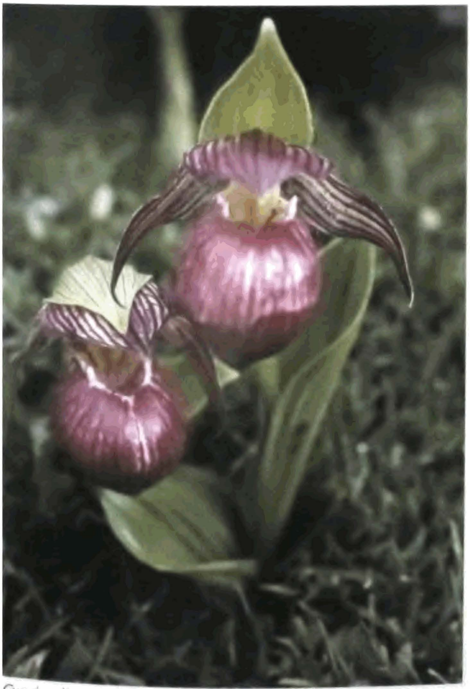
GENERAL DISTRIBUTION. NE India, Myanmar, through SE Asia, China, Malaysia, Sumatra and Borneo.



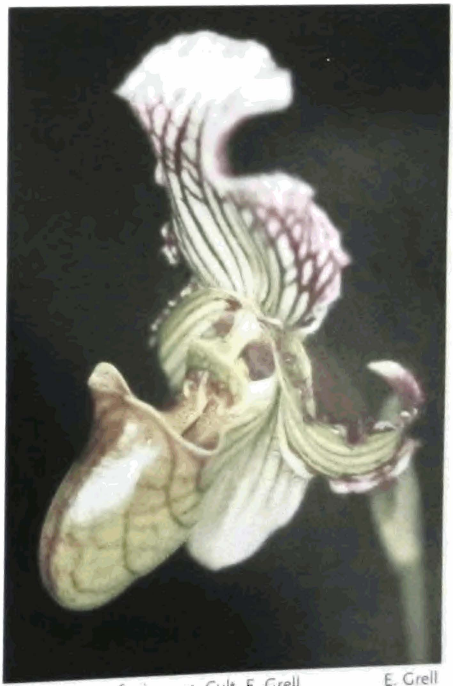
Cypripedium cordigerum. Bhutan. P.J. Cribb



Cypripedium guttatum. Yunnan, China. P.J. Cribb

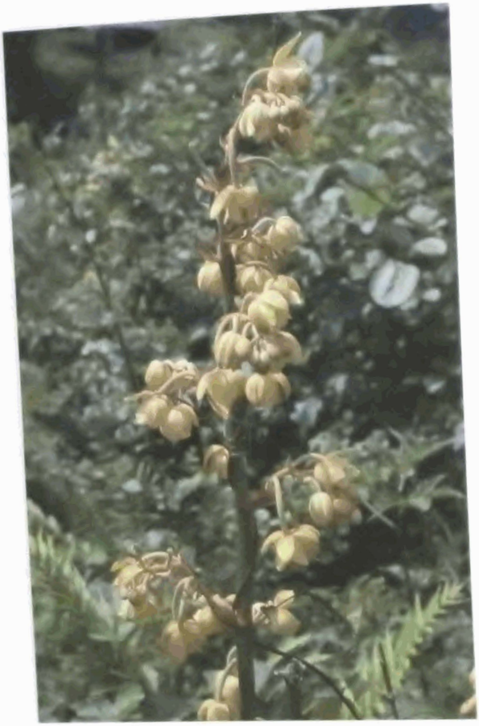


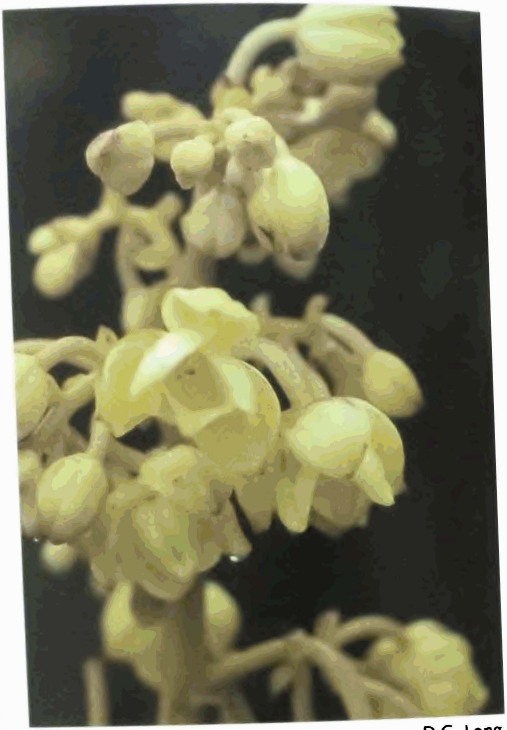
Cypripedium himalaicum. Bhutan. D.C. Lang

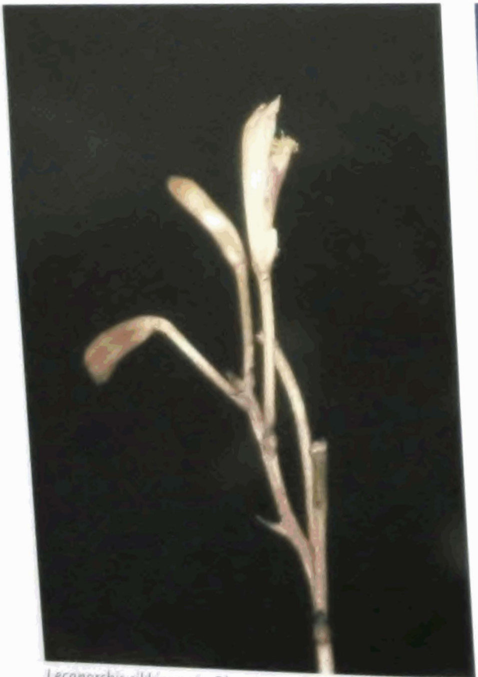


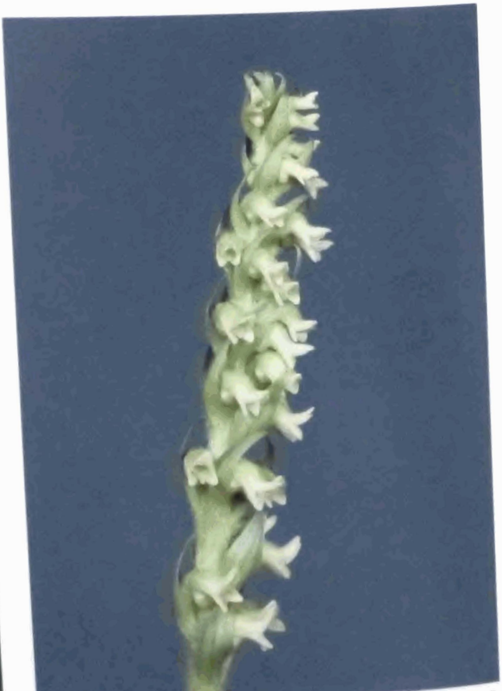
Paphiopedilum fairrieanum. Cult. E. Grell. E. Grell

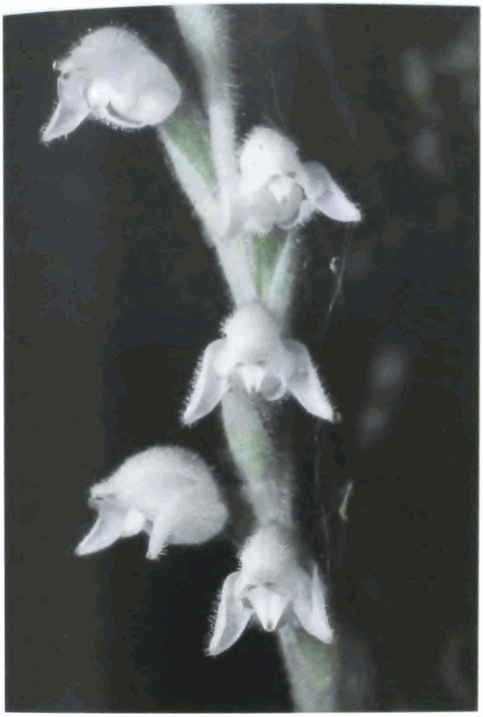
LATE 4


Galeola falconeri. Bhutan. D.G. Long

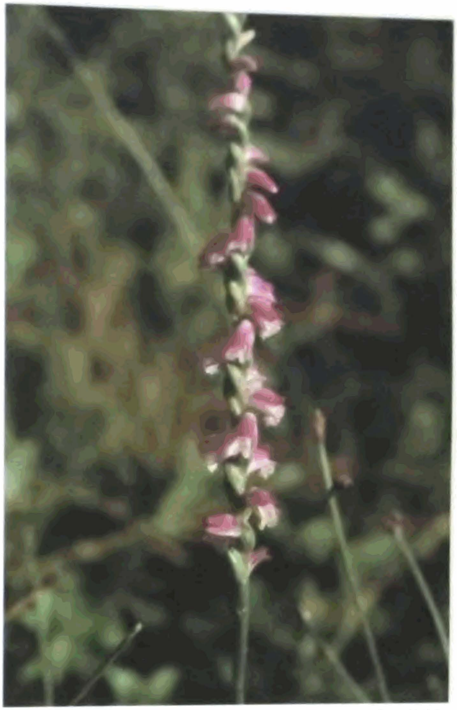

Galeola lindleyana. Bhutan. D.G. Long


Lecanorchis sikkimensis. Bhutan. P.J. Cribb

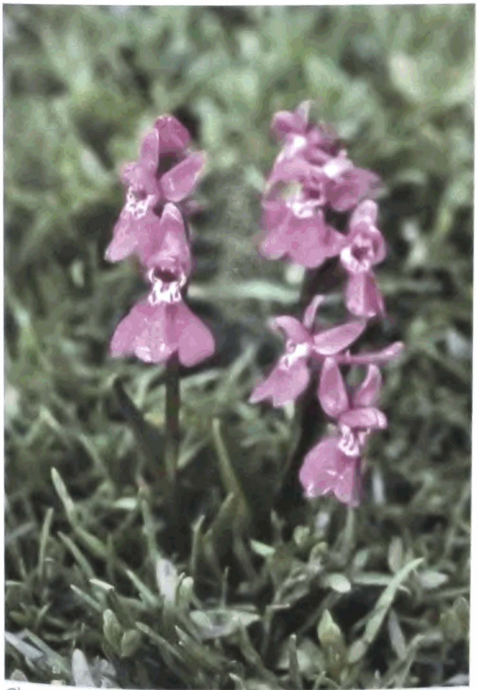

Goodyera fusca. Cult. R.B.G.E. ex Sikkim. K. Grant



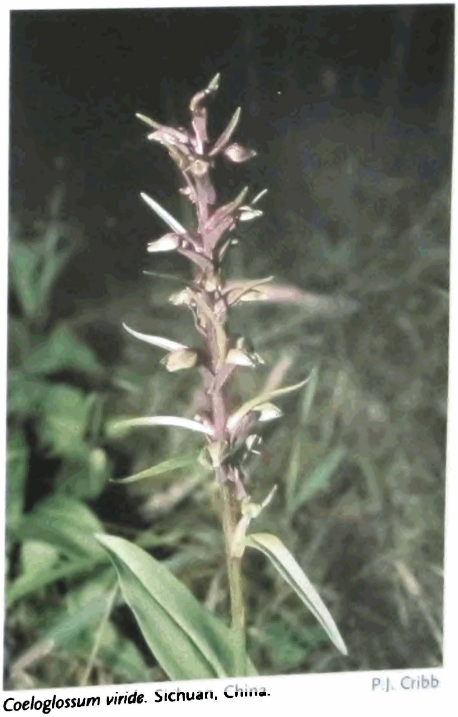
Goodyera schlechtendaliana. Vietnam. P.J. Cribb



Spiranthes sinensis. Yunnan, China. P.J. Cribb

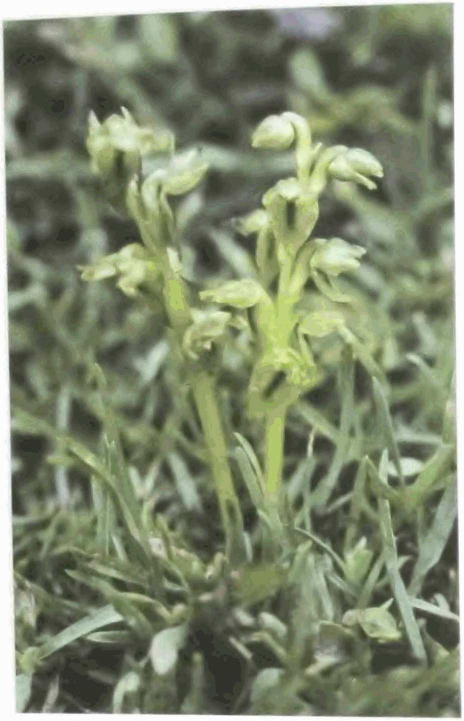


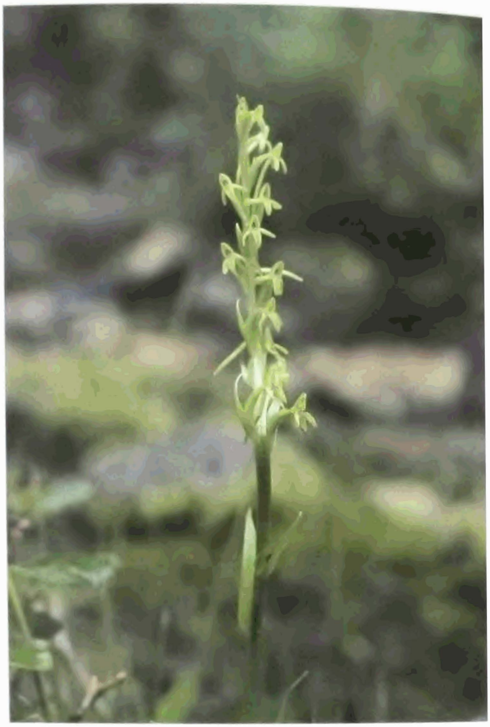
Chusua pauciflora. Bhutan. D.C. Lang

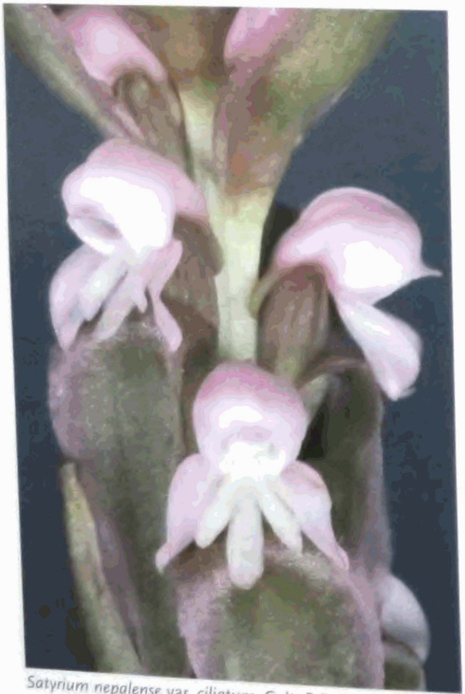


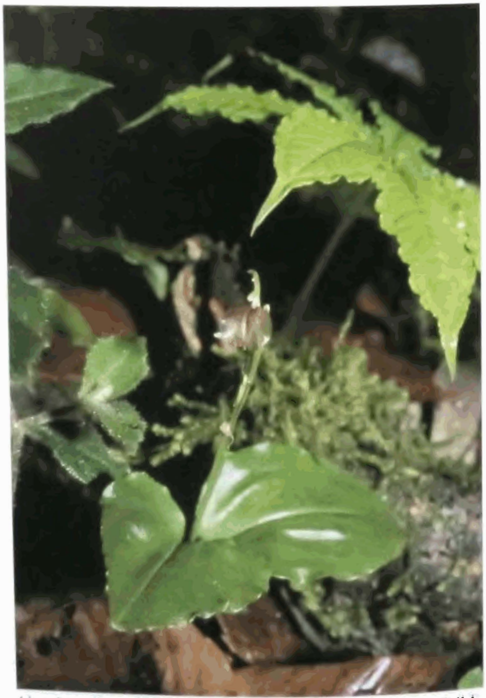
Coeloglossum viride. Sichuan, China. P.J. Cribb

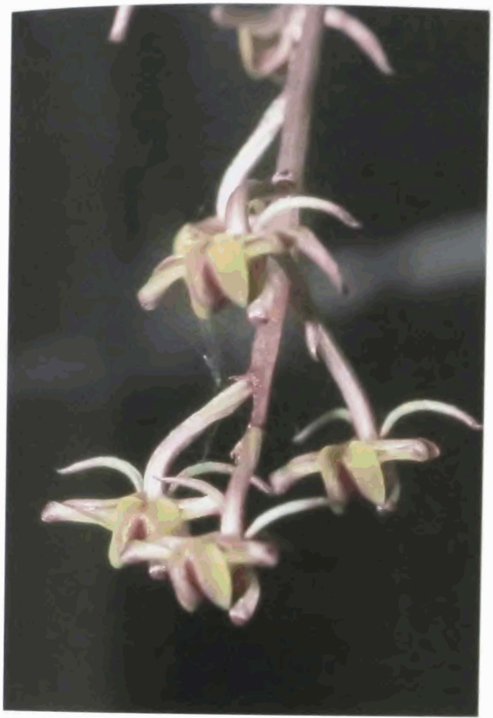
PLATE 6


Herminium josephi. Bhutan. D.C. Lang

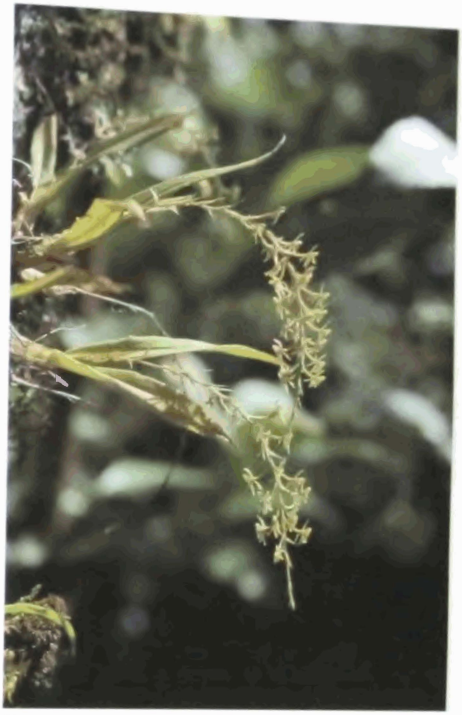

Platanthera leptocaulon. Bhutan. D.G. Long


Satyrium nepalense var. *ciliatum*. Cult. R.B.G.E. ex Bhutan.
K. Grant

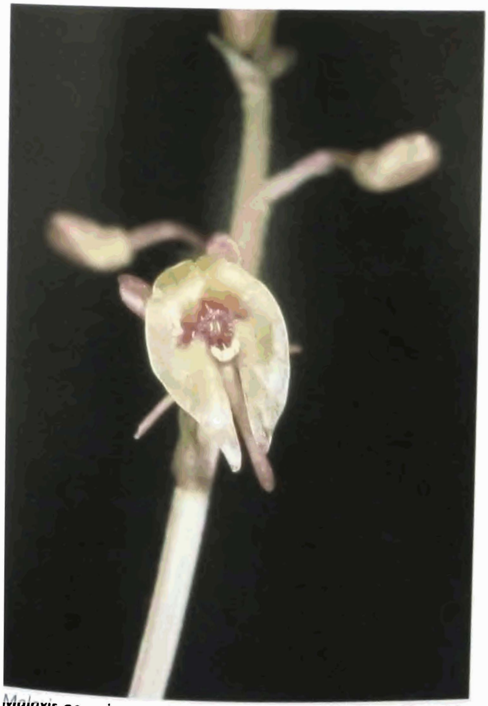

Liparis cathcartii. Bhutan. P.J. Cribb



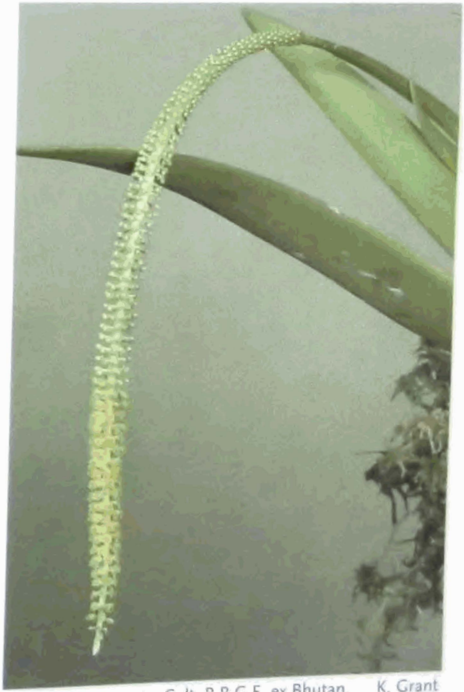
Liparis nervosa. Hong Kong, China. P.J. Cribb



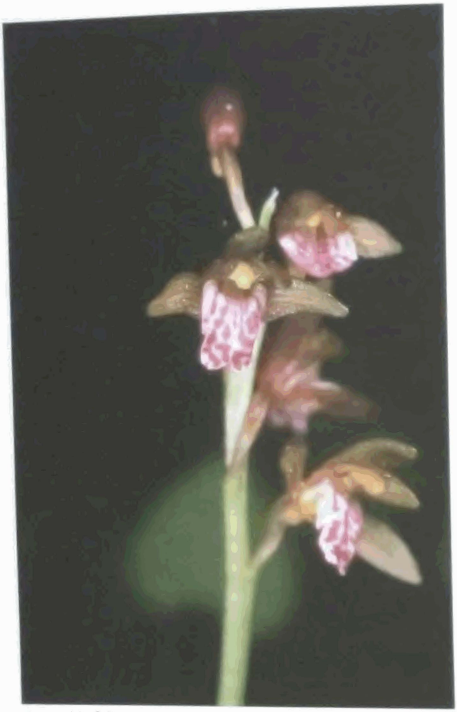
Liparis resupinata. Cult. R.B.G.E. ex Bhutan. K. Grant



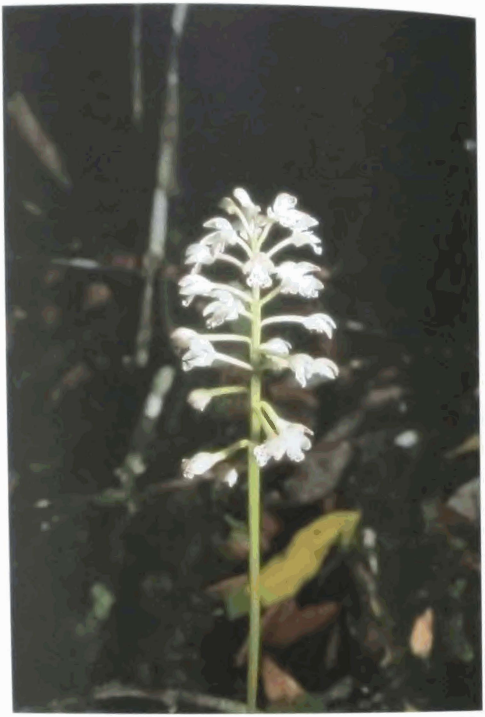
Malaxis acuminata. Bhutan. P.J. Cribb



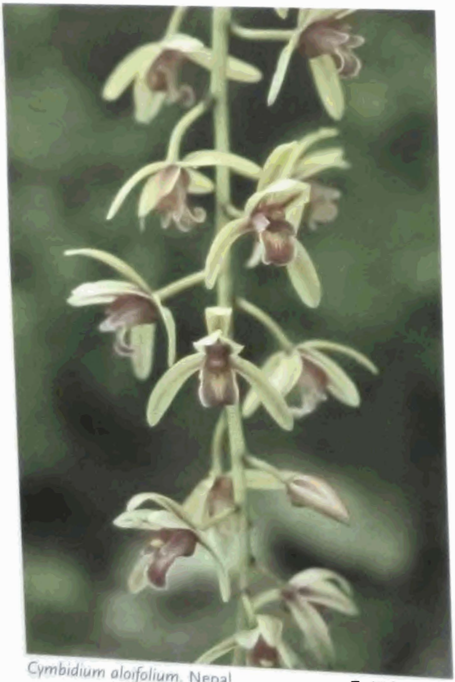
Oberonia mucronata. Cult. R.B.G.E. ex Bhutan. K. Grant



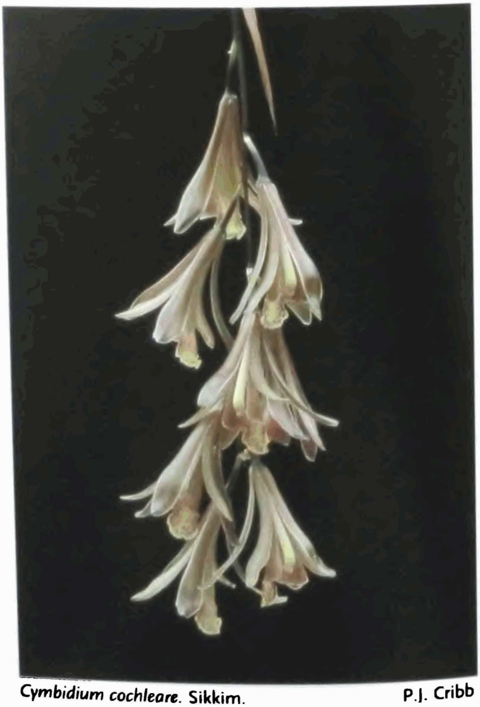
Oreorchis foliosa var. *indica*. Sichuan, China. P.J. Cribb



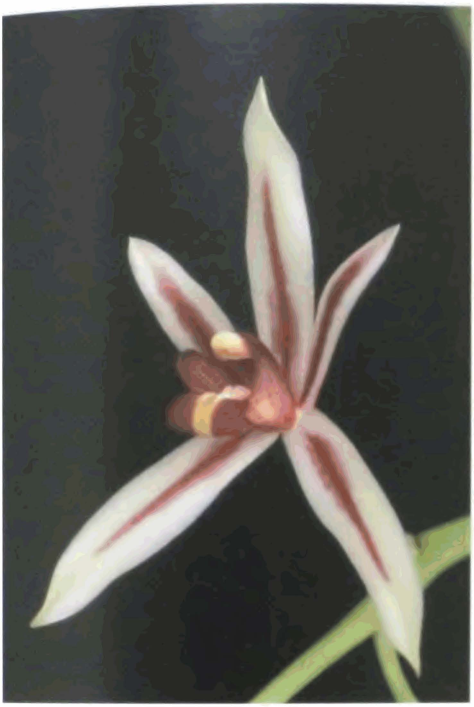
Oreorchis micrantha. Bhutan. P.J. Cribb



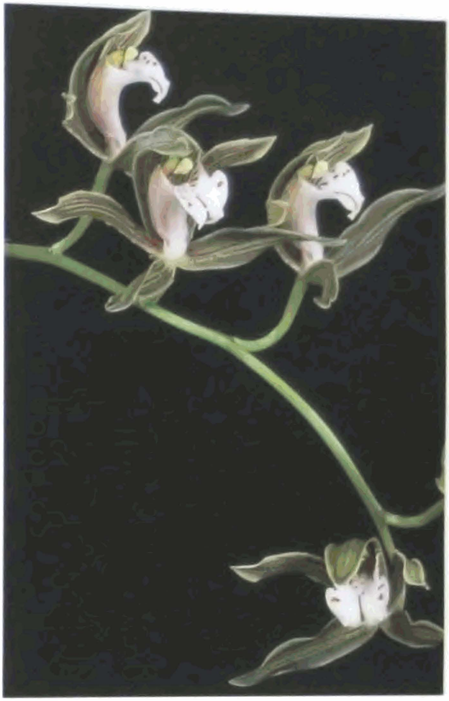
Cymbidium aloifolium. Nepal. G. Kirkpatrick



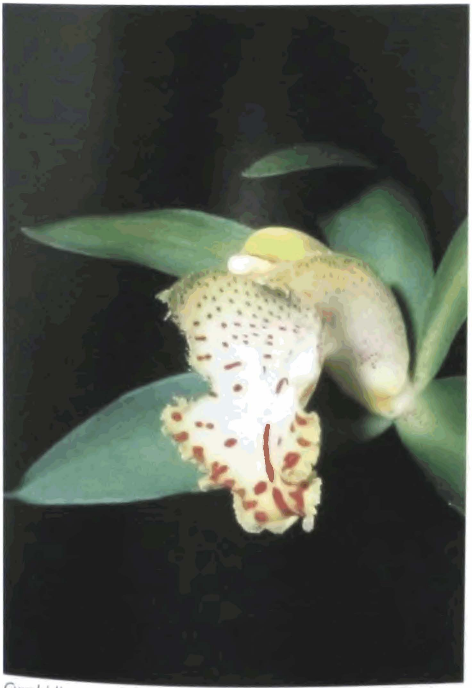
Cymbidium cochleare. Sikkim. P.J. Cribb



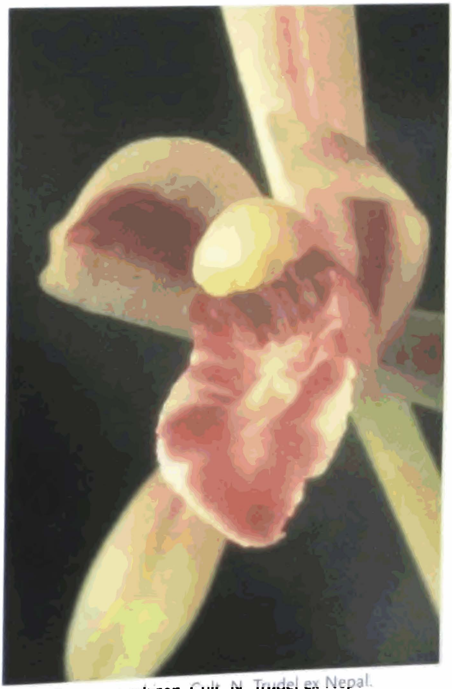
Cymbidium dayanum. Cult. Kew. D.J. Du Puy



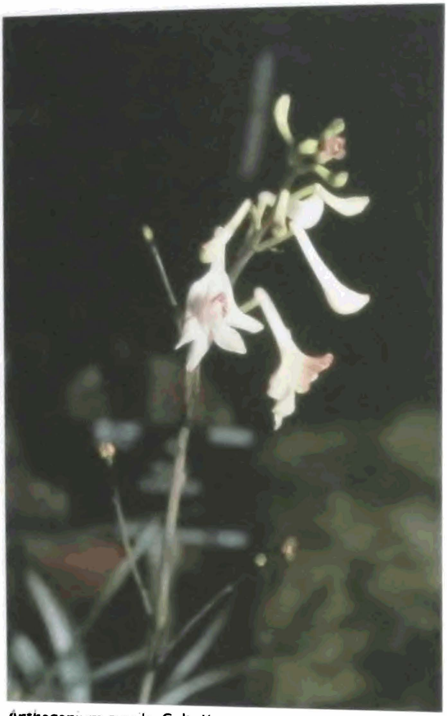
Cymbidium erythraeum. Cult. R.B.G.E. ex Bhutan. K. Grant



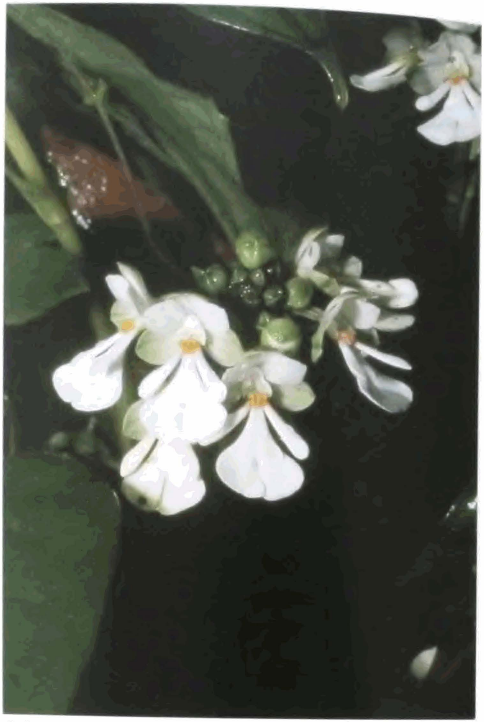
Cymbidium hookerianum. Cult. Kew. D.J. Du Puy



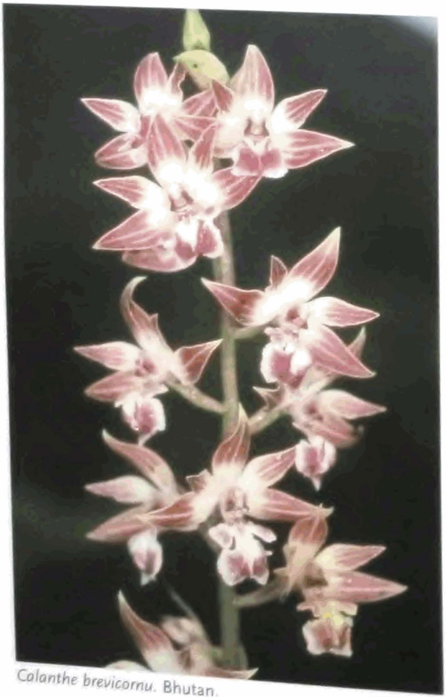
Cymbidium macrorhizon. Cult. N. Trudel ex Nepal. N. Trudel



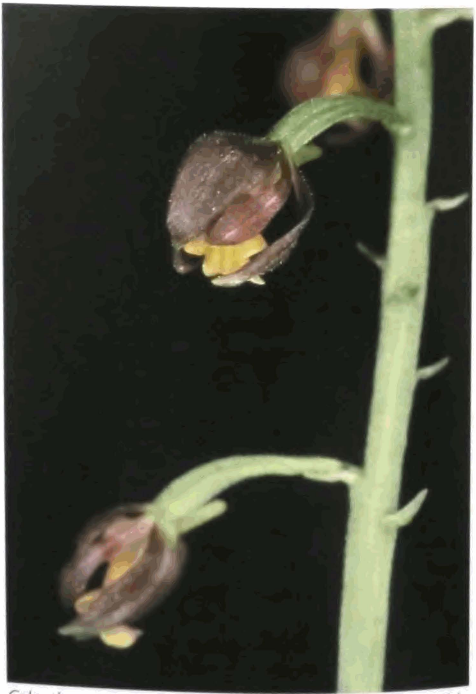
Anthogonium gracile. Cult. Kew. P.J. Cribb



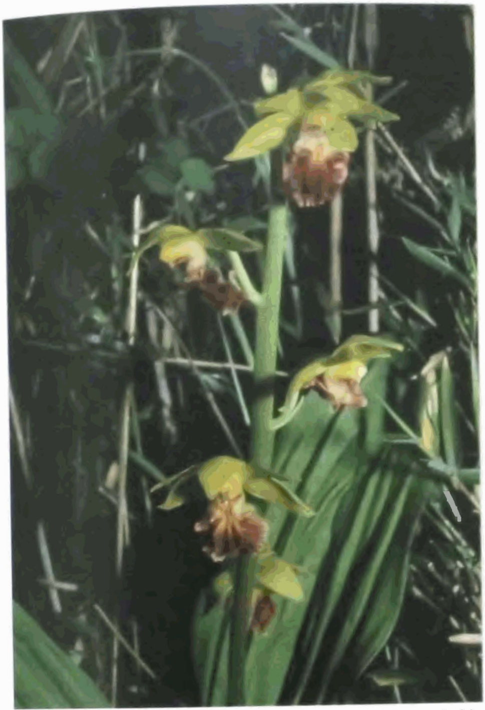
Calanthe alismifolia. Bhutan. P.J. Cribb



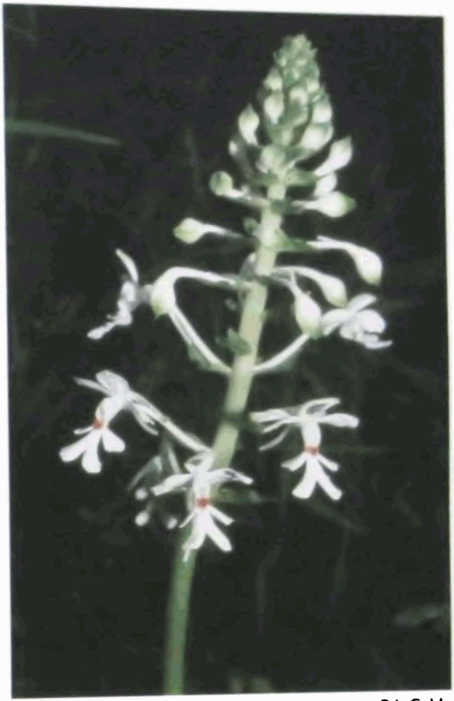
Calanthe brevicornu. Bhutan. P.J. Cribb



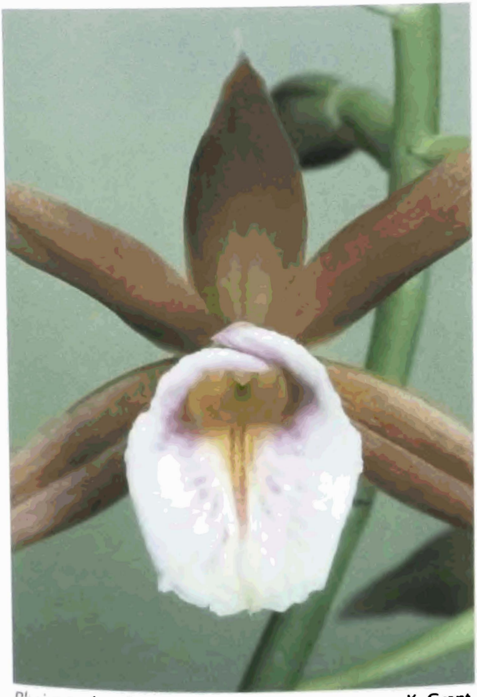
Calanthe mannii. Bhutan. P.J. Cribb



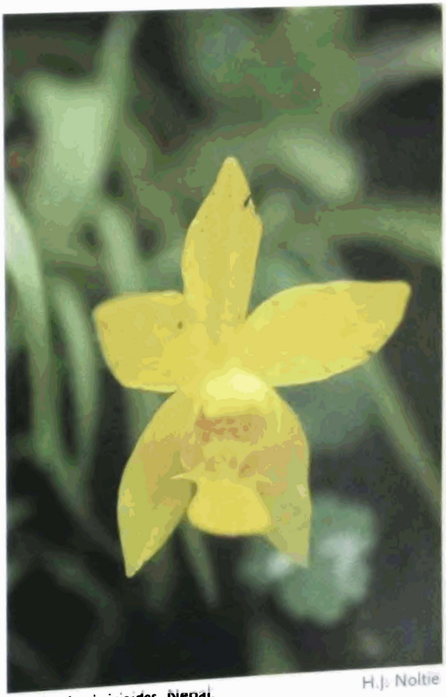
Calanthe tricarinata. Bhutan. P.J. Cribb



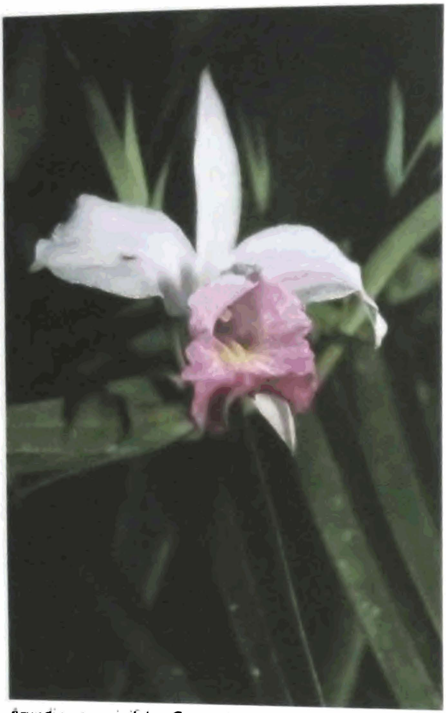
Calanthe triplicata. Bhutan. P.J. Cribb



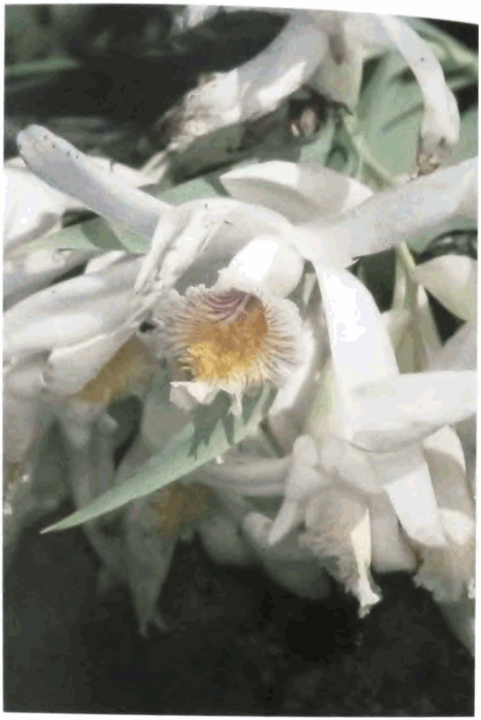
Phaius tankervilleae. Cult. R.B.G.E. K. Grant



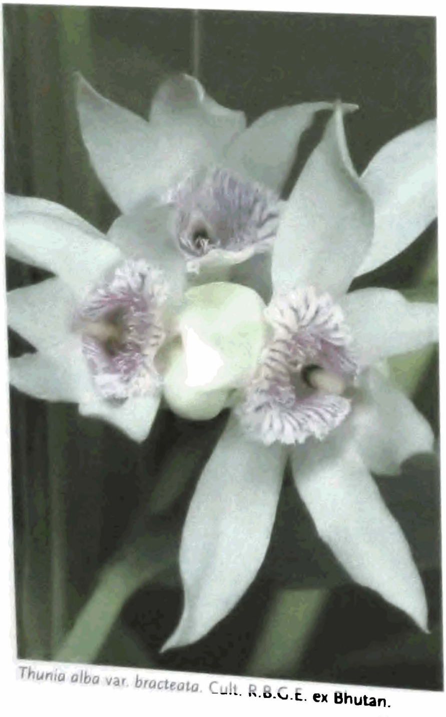
Spathoglottis ixioides. Nepal. H.J. Noltie



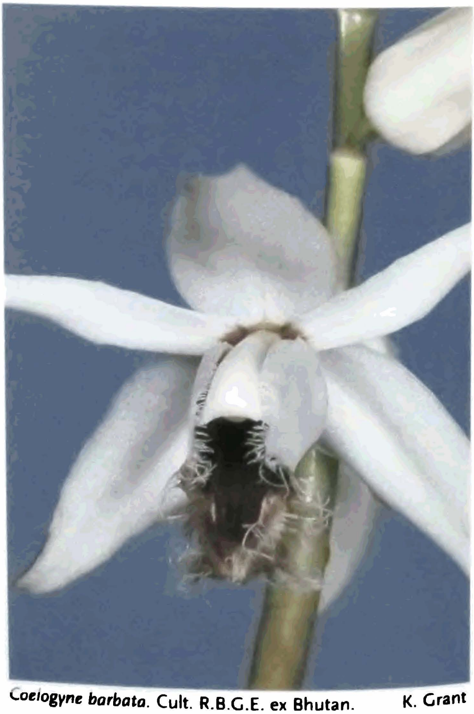
Arundina graminifolia. Guangxi, China. P.J. Cribb



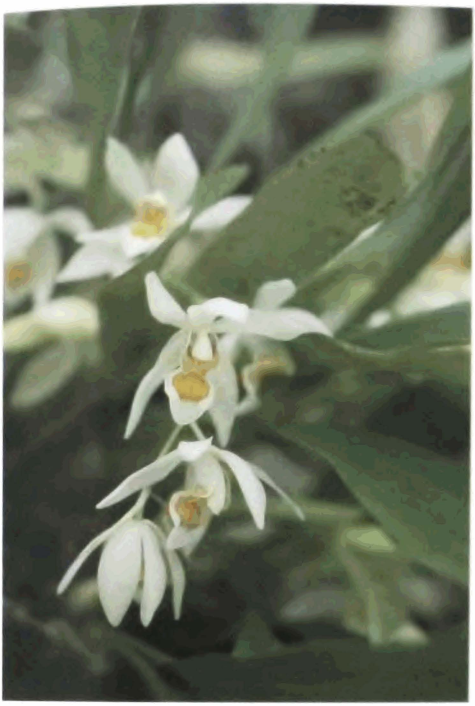
Thunia alba var. *alba*. Bhutan. P.J. Cribb



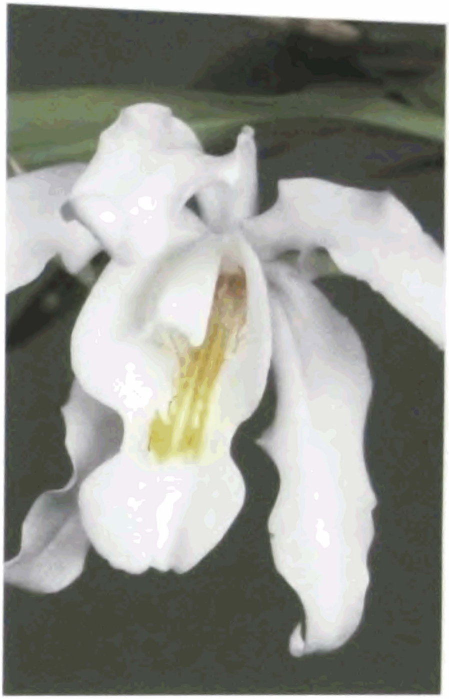
Thunia alba var. *bracteata*. Cult. R.B.G.E. ex Bhutan. K. Grant



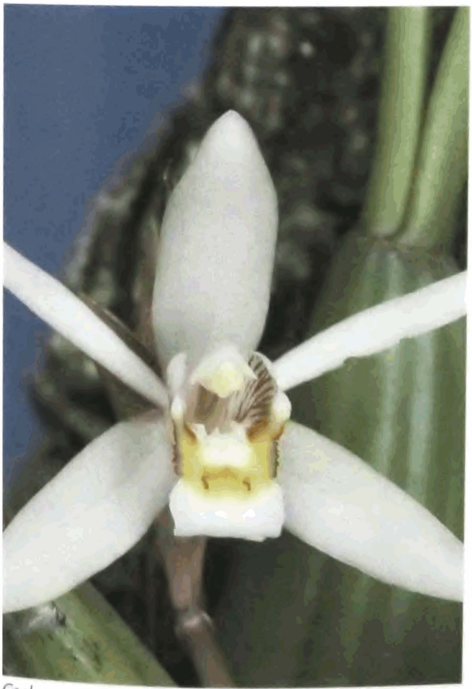
Coelogyne barbata. Cult. R.B.G.E. ex Bhutan. K. Grant



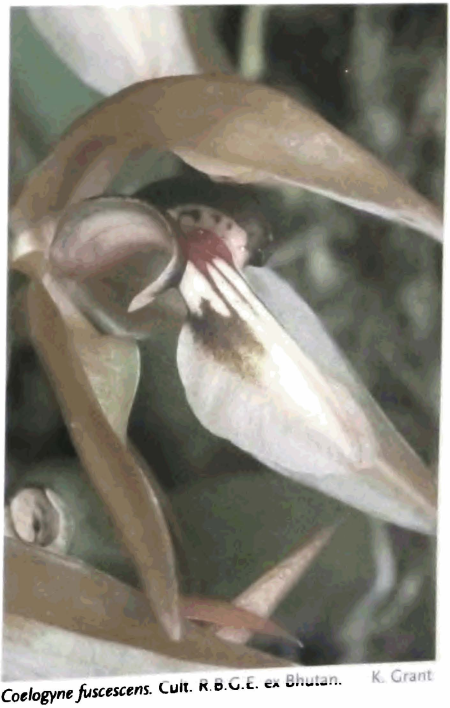
Coelogyne corymbosa. Bhutan. A.J.C. Grierson



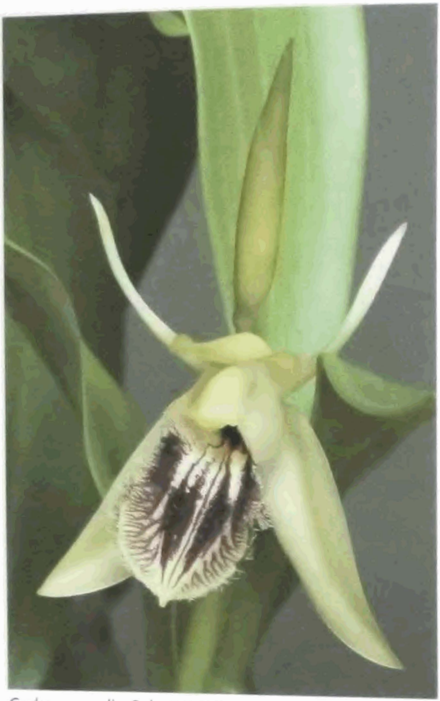
Coelogyne cristata. Cult. R.B.G.E. ex Nepal. K. Grant



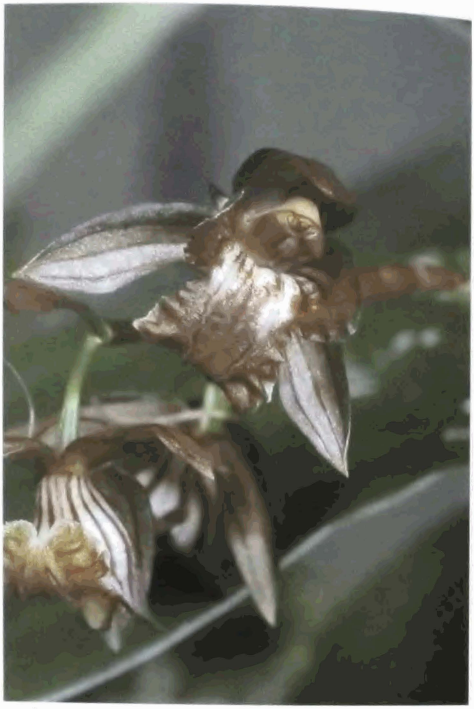
Coelogyne flaccida. Cult. R.B.G.E. ex Bhutan. K. Grant



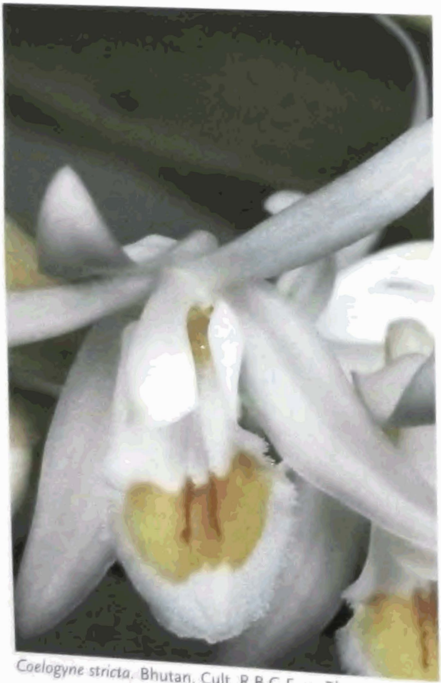
Coelogyne fuscescens. Cult. R.B.G.E. ex Bhutan. K. Grant



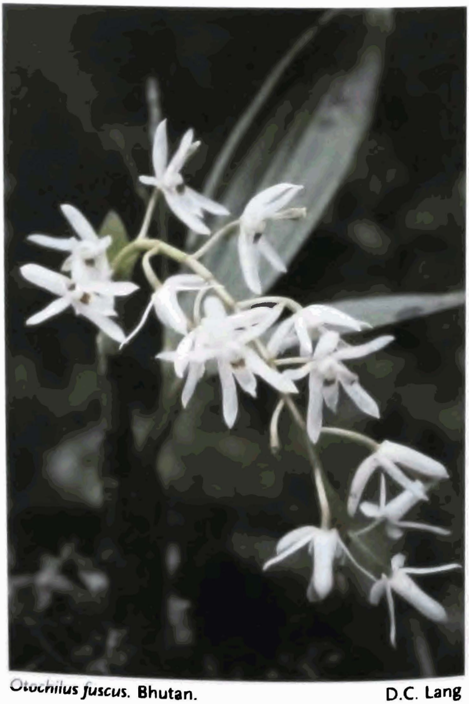
Coelogyne ovalis. Cult. R.B.G.E. ex Bhutan. K. Grant



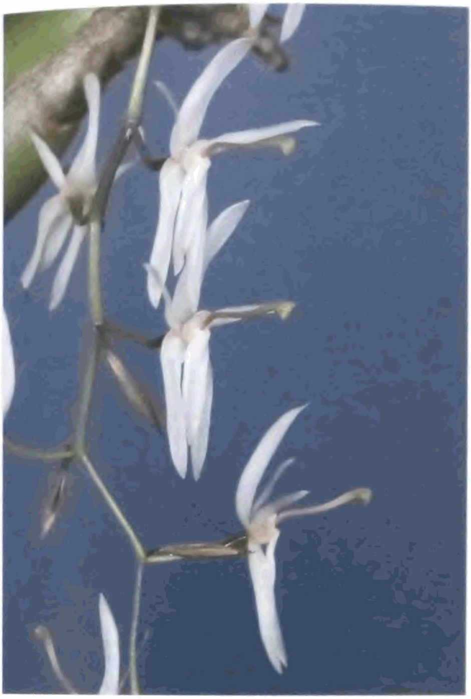
Coelogyne schultesii. Bhutan. D.G. Long



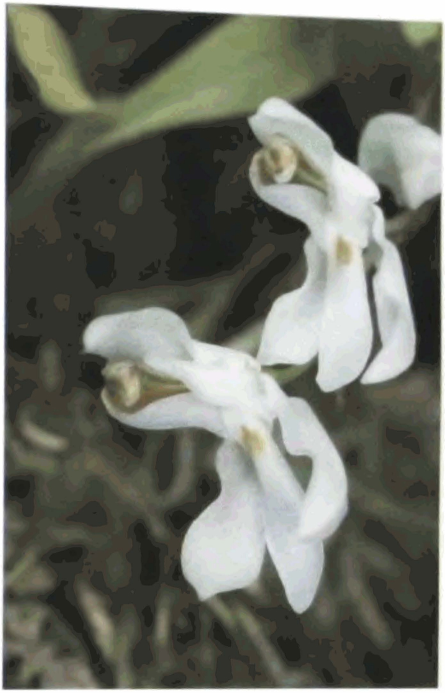
Coelogyne stricta. Bhutan. Cult. R.B.G.E. ex Bhutan. K. Grant



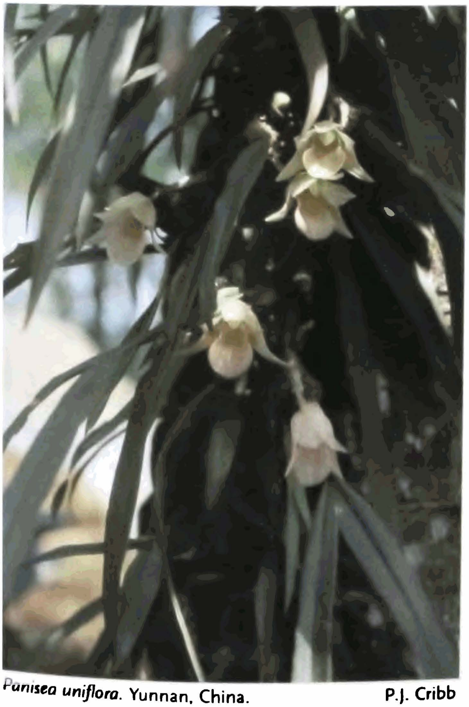
Otochilus fuscus. Bhutan. D.C. Lang



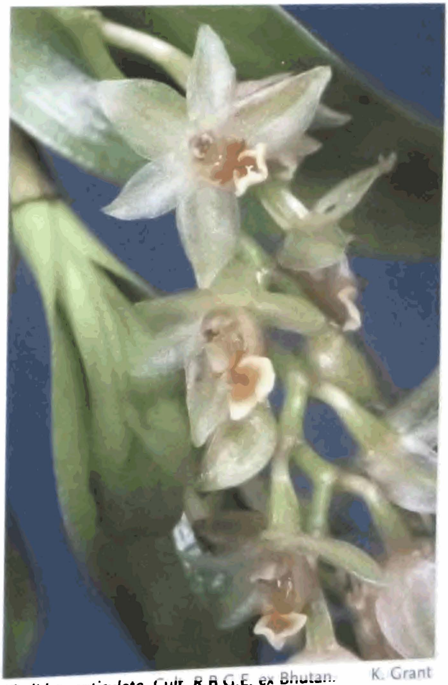
Otochilus lancilabius. Cult. R.B.G.E. ex Bhutan. K. Grant



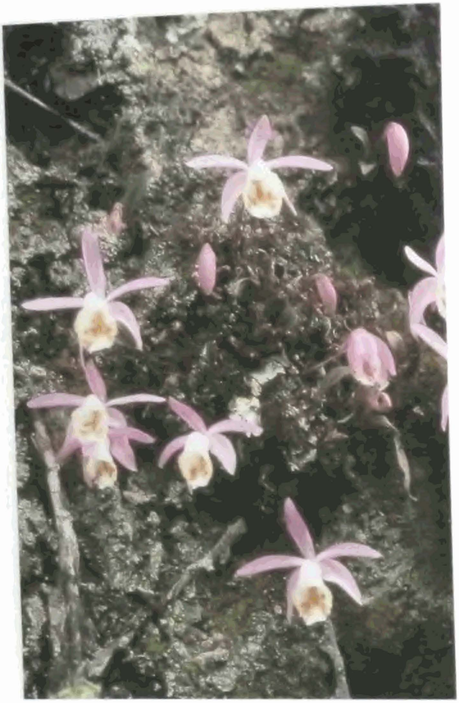
Panisea demissa. Cult. R.B.G.E. ex Bhutan. K. Grant



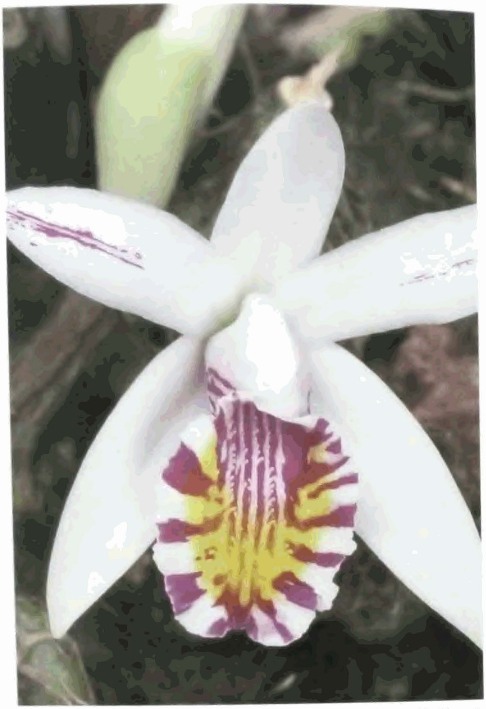
Panisea uniflora. Yunnan, China. P.J. Cribb



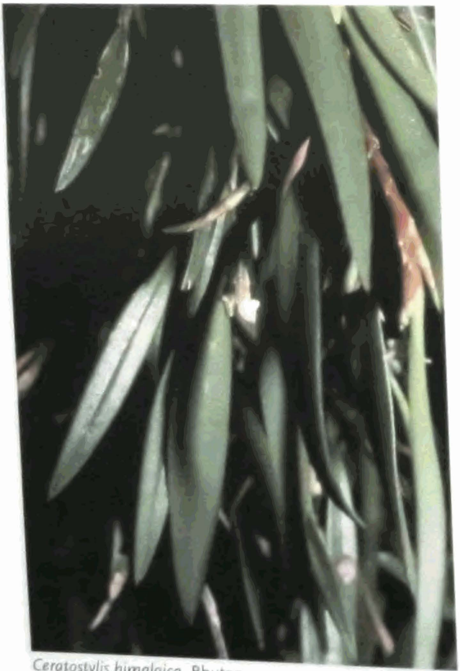
Pholidota articulata. Cult. R.B.G.E. ex Bhutan. K. Grant



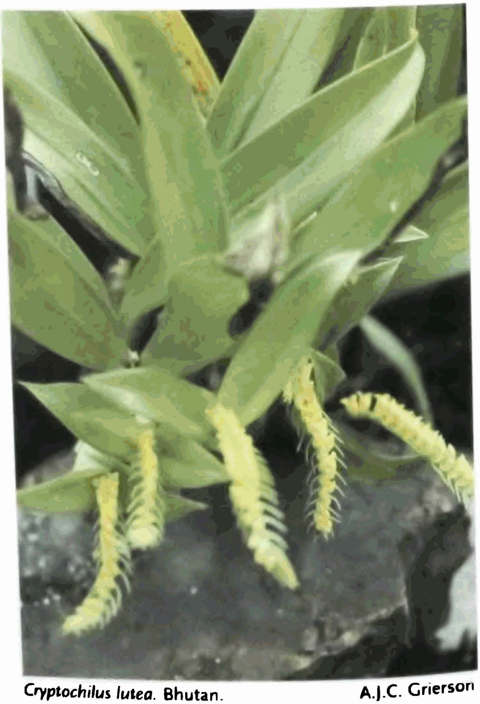
Pleione hookeriana. Bhutan. P.J. Cribb



Pleione maculata. Cult. R.B.G.E. ex Bhutan. K. Grant

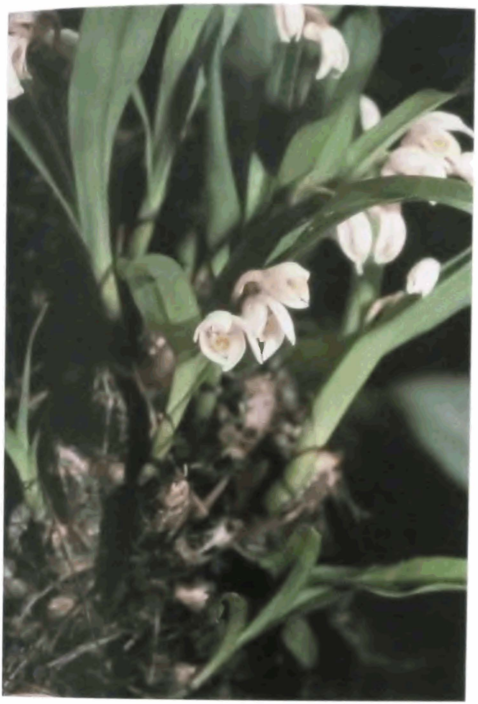


Ceratostylis himalaica. Bhutan. P.J. Cribb

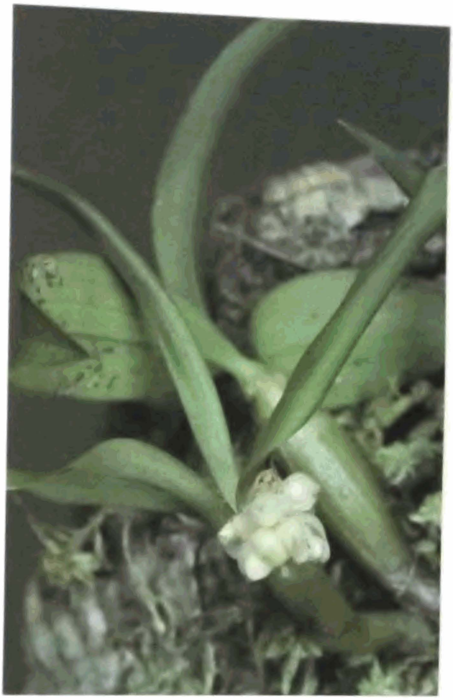


Cryptochilus lutea. Bhutan. A.J.C. Grierson

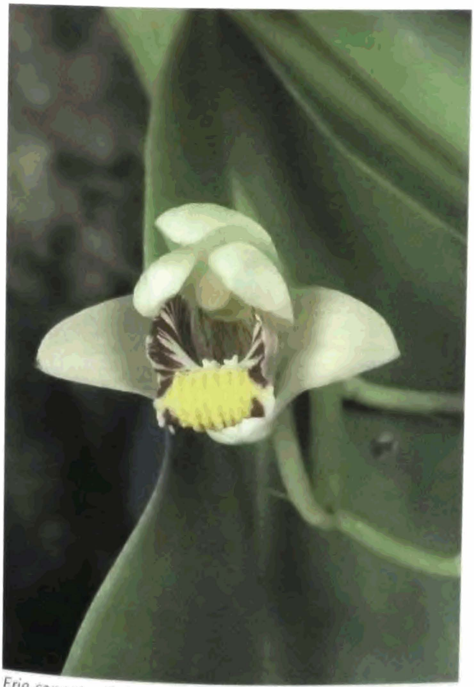
PLATE 17. The specific names *coronaria* and *connata* in the photographs top right and bottom left should be reversed.



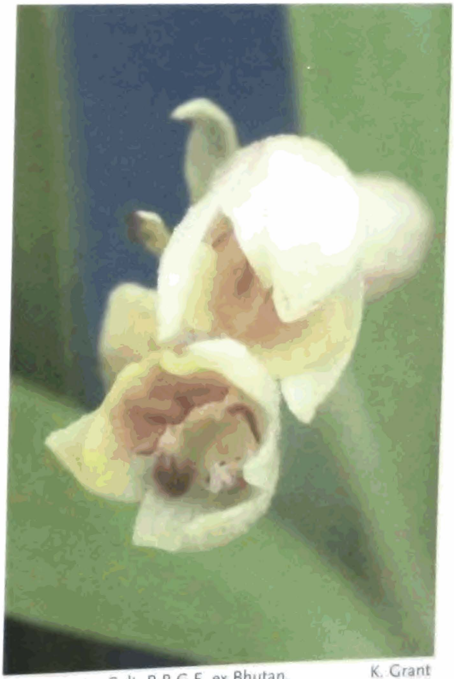
Eria alba. Bhutan. P.J. Cribb



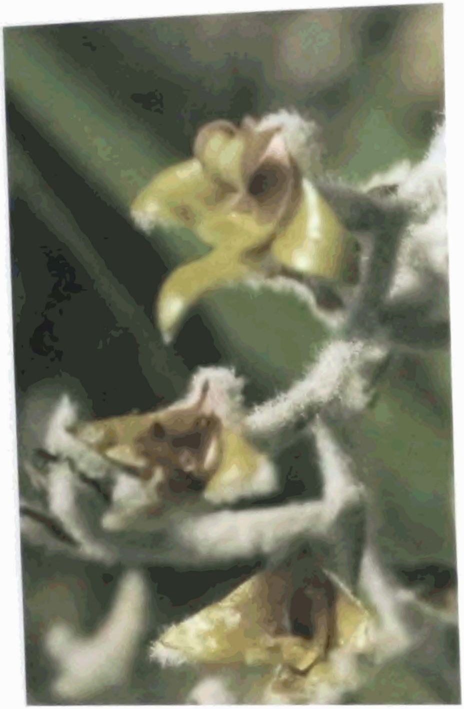
Eria coronaria. Cult. R.B.G.E. ex Bhutan. K. Grant



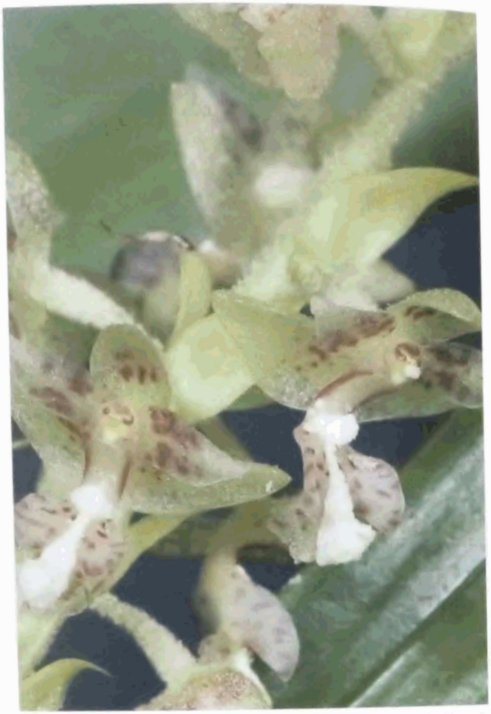
Eria connata. Cult. R.B.G.E. ex Bhutan. K. Grant



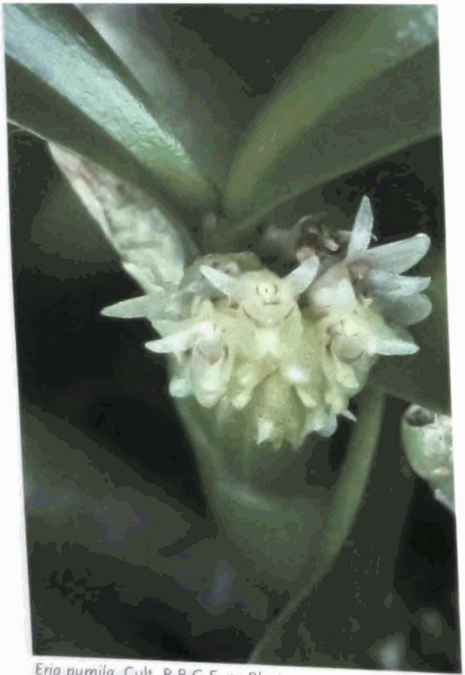
Eria excavata. Cult. R.B.G.E. ex Bhutan. K. Grant



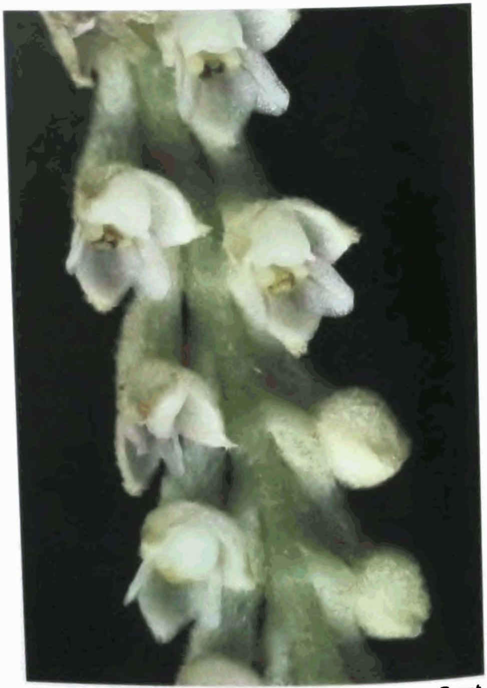
Eria lasiopetala. Bhutan. A.J.C. Grierson



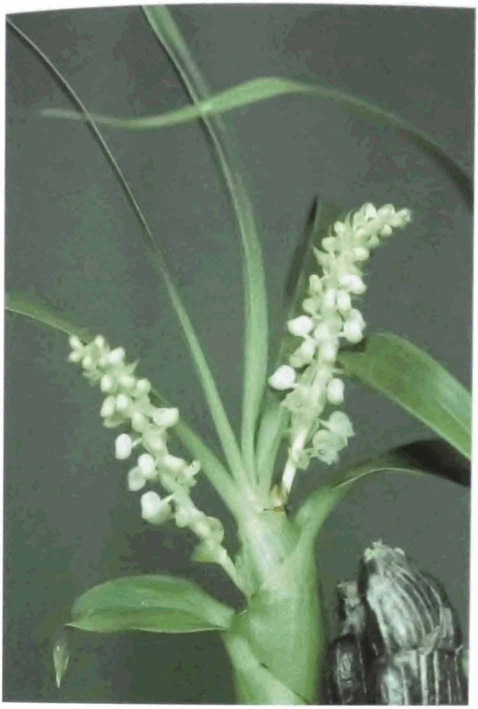
Eria paniculata. Cult. R.B.G.E. ex Bhutan. K. Grant



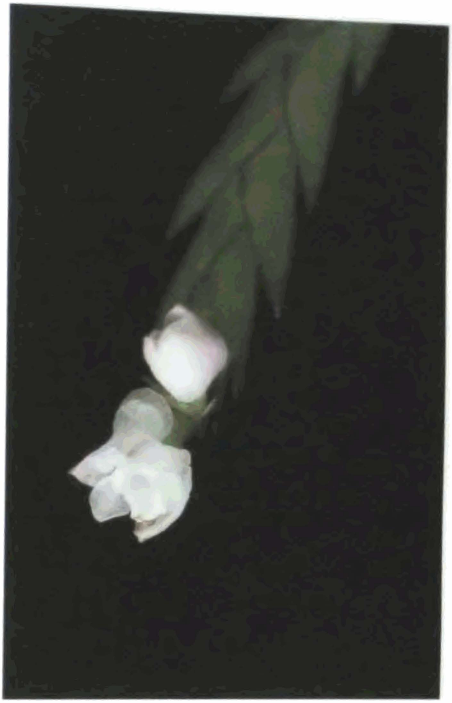
Eria pumila. Cult. R.B.G.E. ex Bhutan. K. Grant



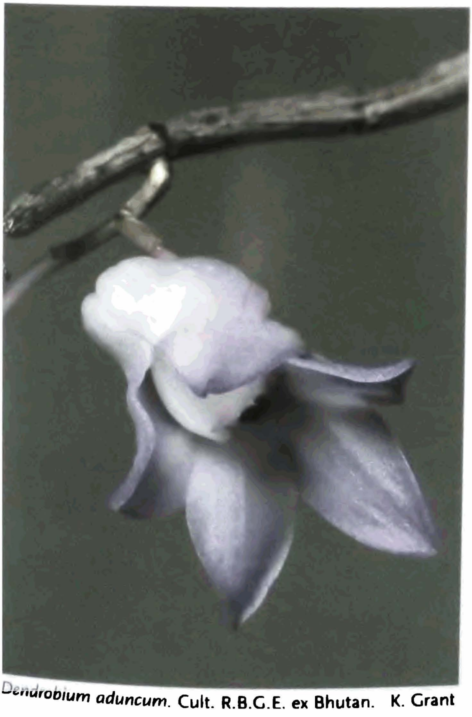
Eria spicata. Cult. R.B.G.E. ex Bhutan. K. Grant



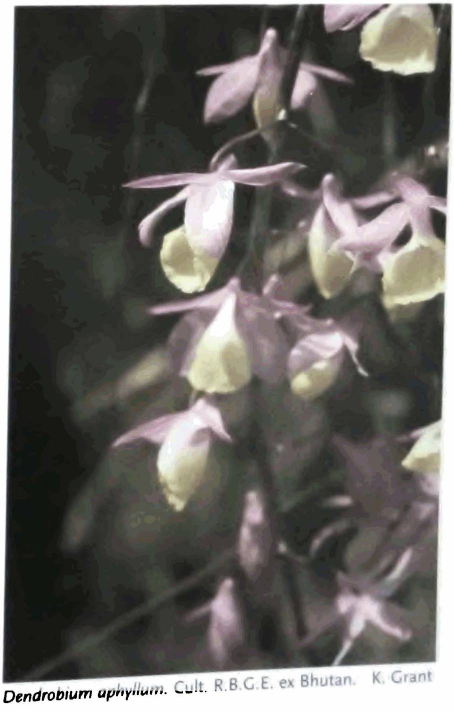
Eria stricta. Cult. R.B.G.E. ex Bhutan. K. Grant



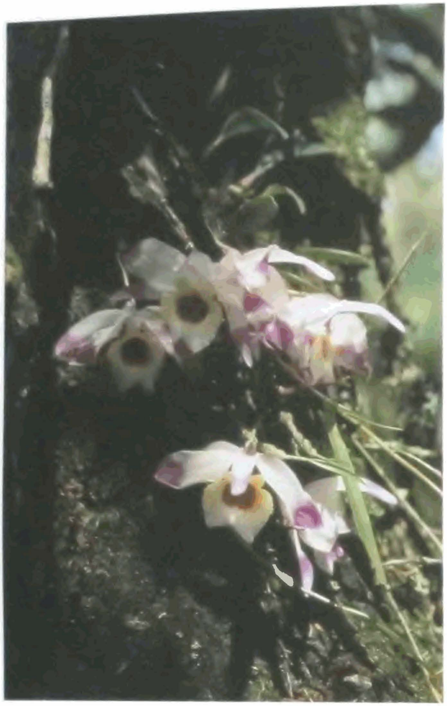
Podochilus cultratus. Cult. R.B.G.E. ex Bhutan. K. Grant



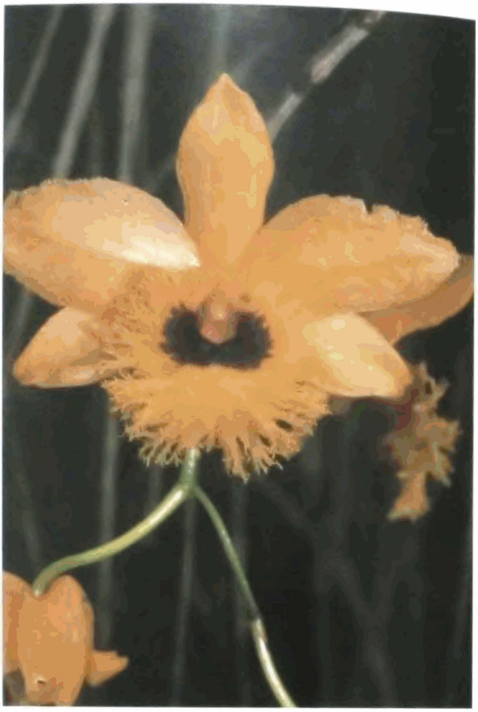
Dendrobium aduncum. Cult. R.B.G.E. ex Bhutan. K. Grant



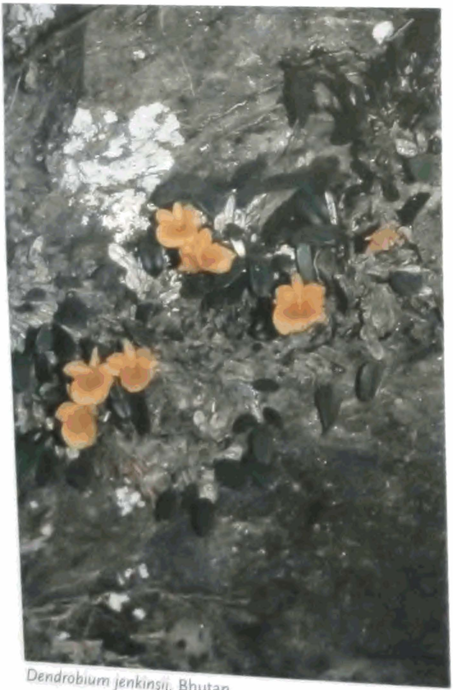
Dendrobium aphyllum. Cult. R.B.G.E. ex Bhutan. K. Grant



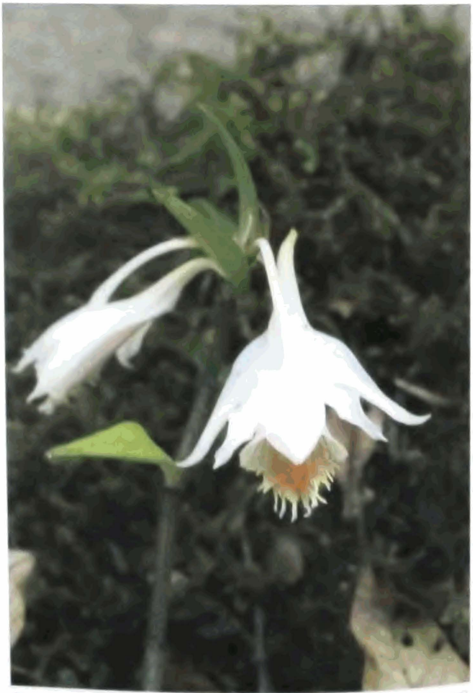
Dendrobium falconeri. Bhutan. P.J. Cribb



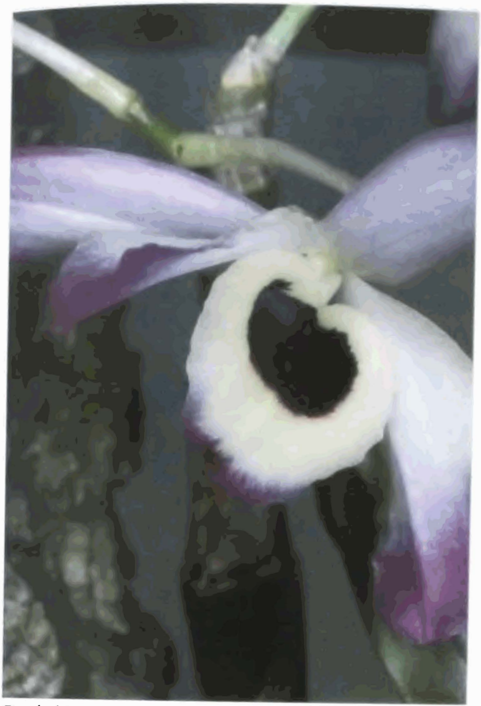
Dendrobium fimbriatum. Bhutan. P.J. Cribb



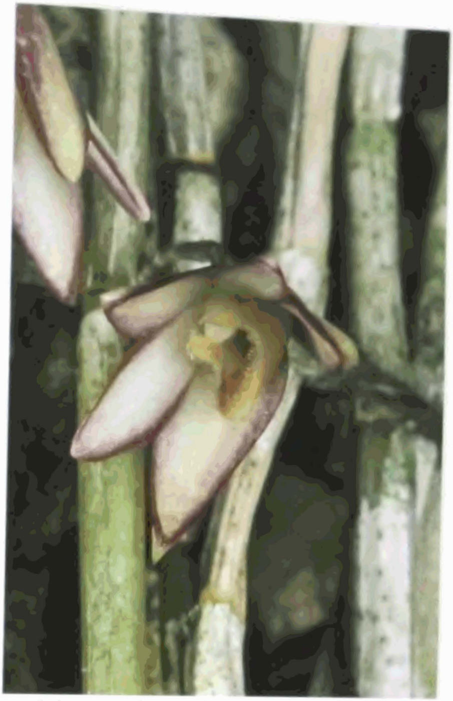
Dendrobium jenkinsii. Bhutan. P.J. Cribb



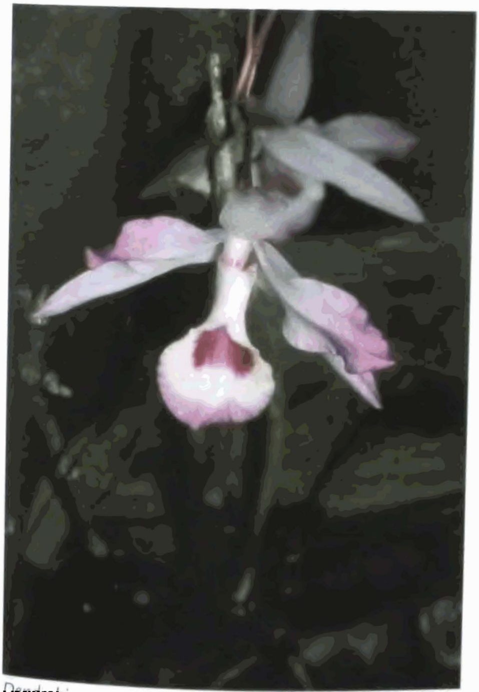
Dendrobium longicornu. Bhutan. D.G. Long



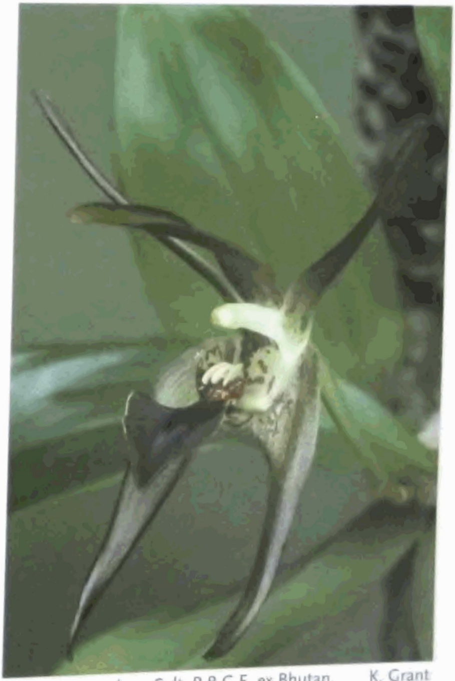
Dendrobium nobile. Cult. R.B.G.E. ex Bhutan. K. Grant



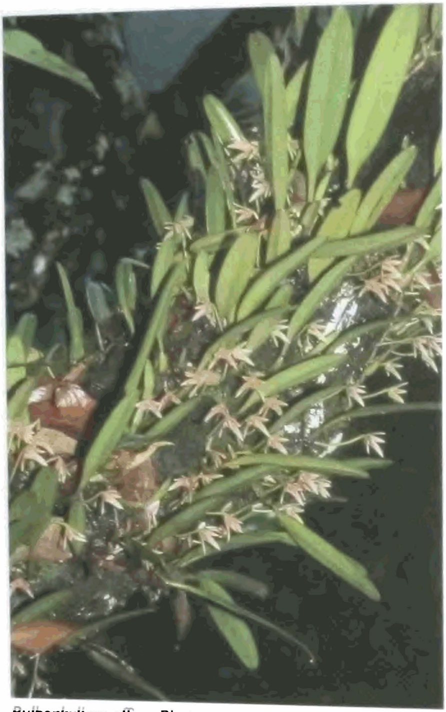
Dendrobium praecinctum. Cult. R.B.G.E. ex Bhutan. K. Grant



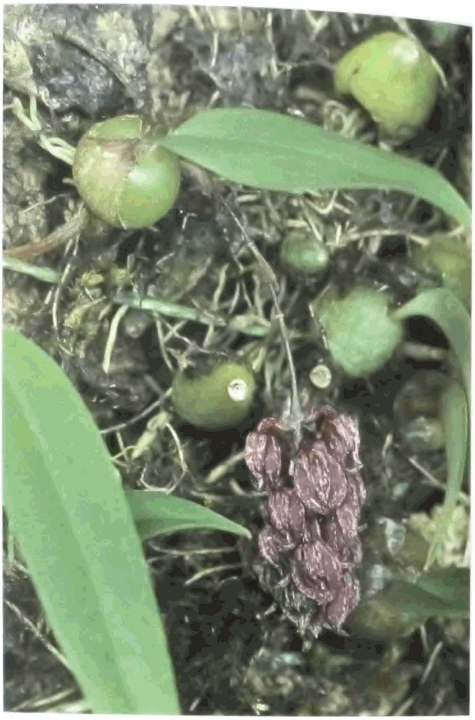
Dendrobium transparens. Bhutan. P.J. Cribb



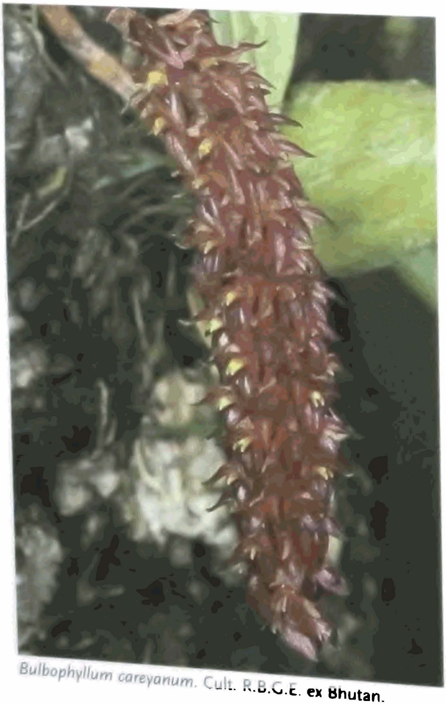
Epigenium amplum. Cult. R.B.G.E. ex Bhutan. K. Grant



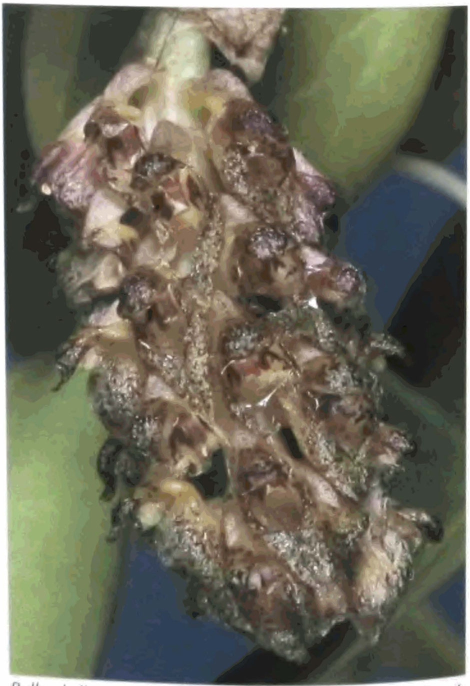
Bulbophyllum affine. Bhutan. P.J. Cribb



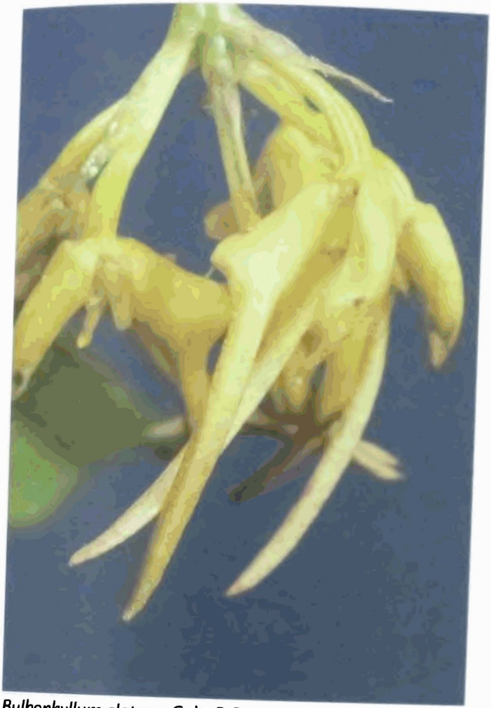
Bulbophyllum bisetum. Cult. R.B.G.E. ex Bhutan. K. Grant



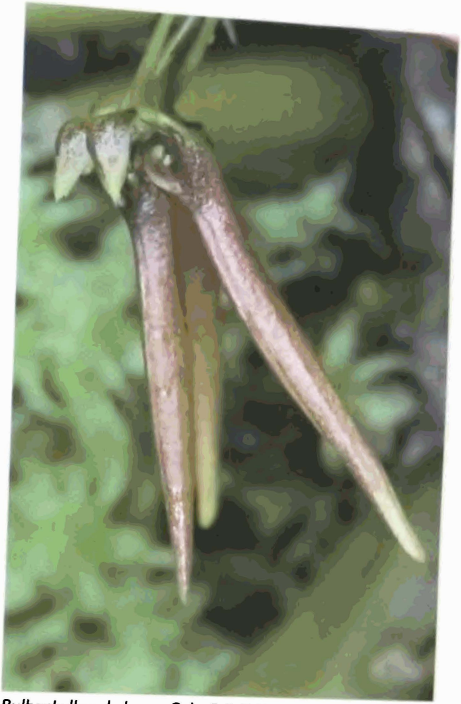
Bulbophyllum careyanum. Cult. R.B.G.E. ex Bhutan. K. Grant



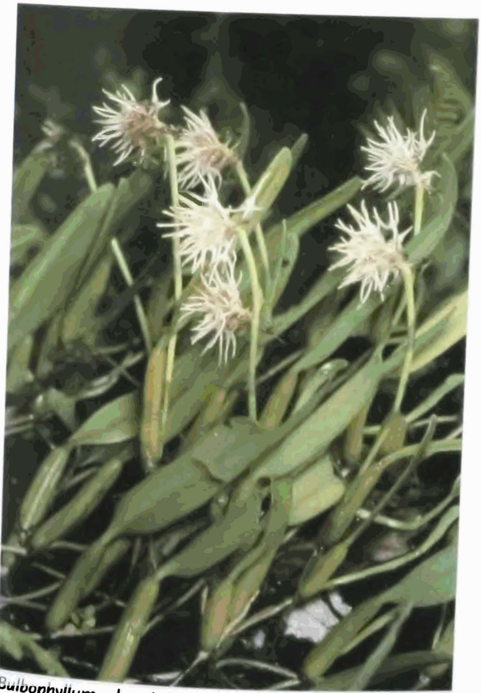
Bulbophyllum crassipes. Cult. R.B.G.E. ex Bhutan. K. Grant



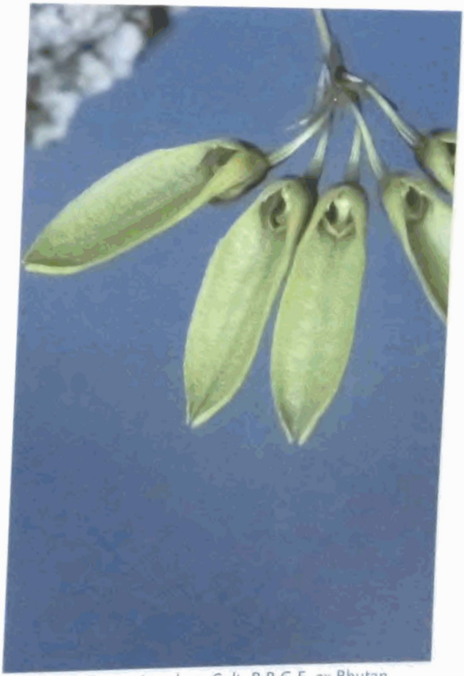
Bulbophyllum elatum. Cult. R.B.G.E. ex Bhutan. K. Grant



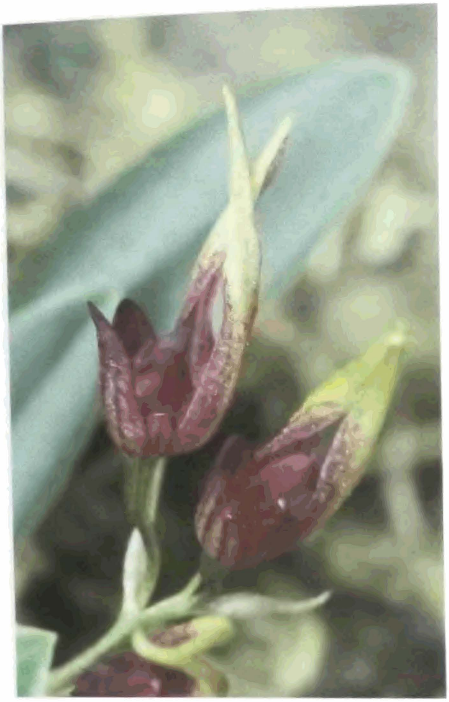
Bulbophyllum helenae. Cult. R.B.G.E. ex Bhutan. K. Grant



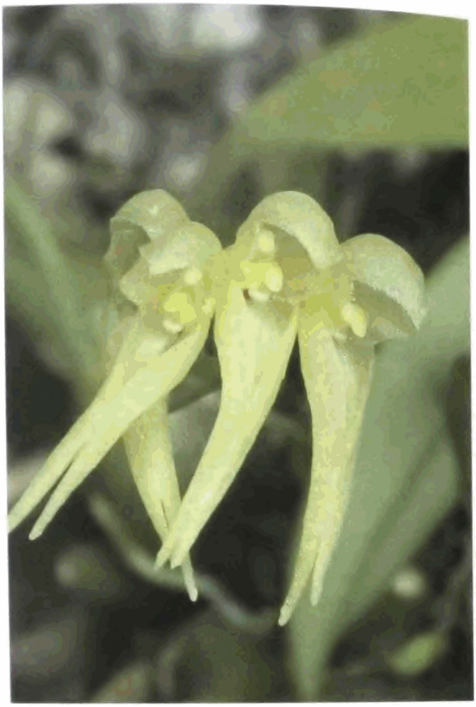
Bulbophyllum odoratissimum. Bhutan. P.J. Cribb



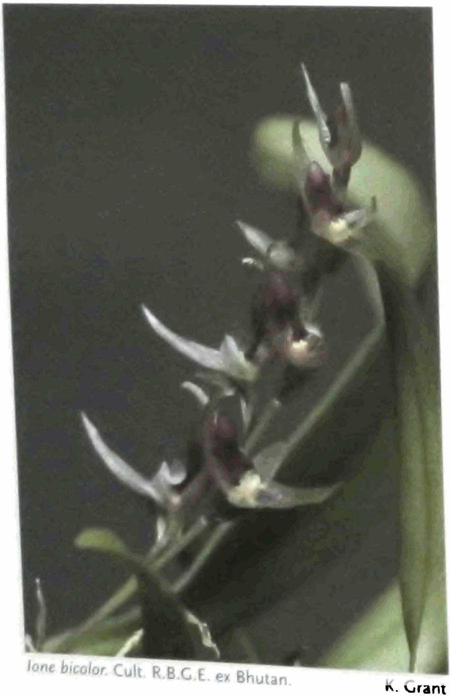
Bulbophyllum retusiusculum. Cult. R.B.G.E. ex Bhutan. K. Grant



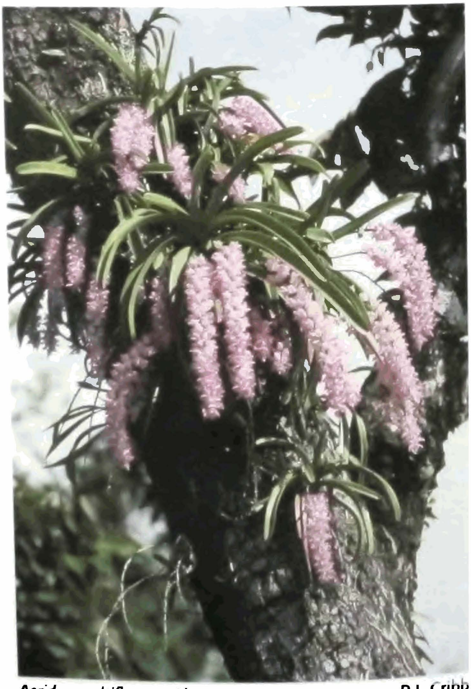
Bulbophyllum rolfei. Cult. R.B.G.E. ex Bhutan. K. Grant



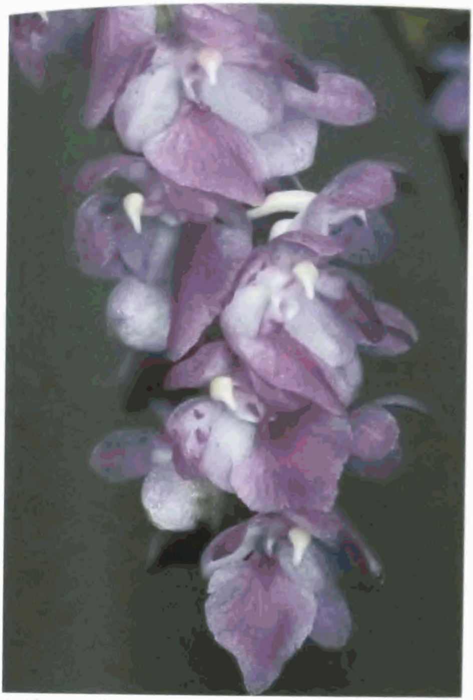
Bulbophyllum scabratum. Cult. R.B.G.E. ex Bhutan. K. Grant



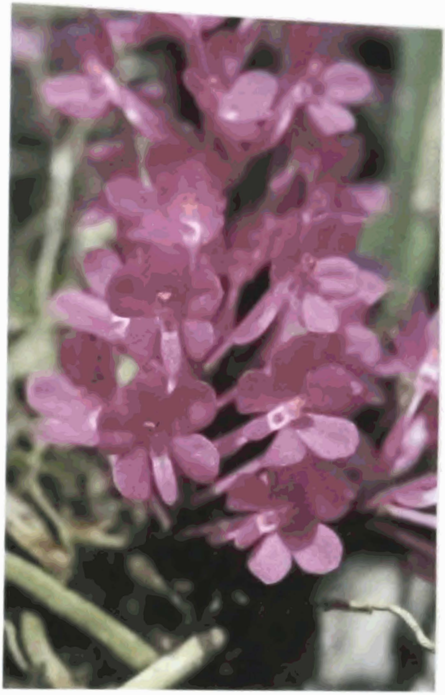
Ione bicolor. Cult. R.B.G.E. ex Bhutan. K. Grant



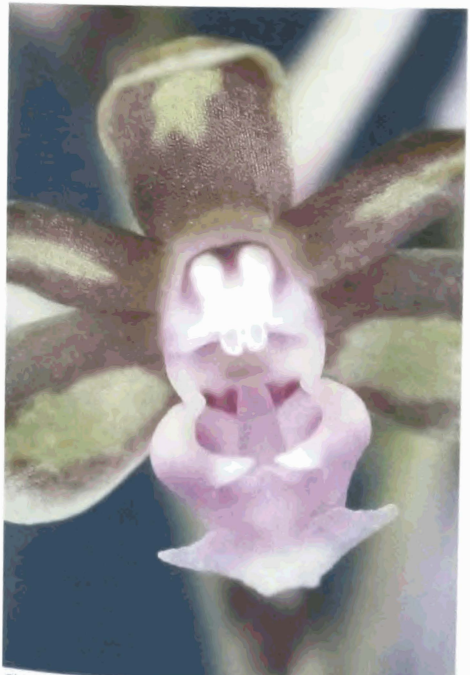
Aerides multiflorum. Bhutan. P.J. Cribb



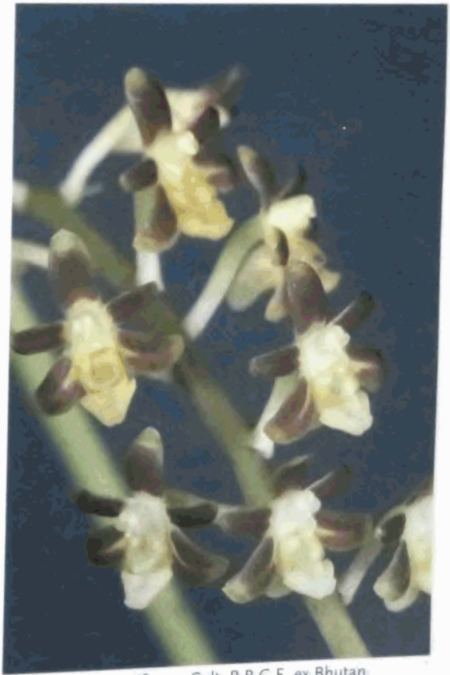
Aerides multiflorum. Cult. R.B.G.E. ex Nepal. K. Grant



Ascocentrum ampullaceum. Cult. R.B.G.E. K. Grant

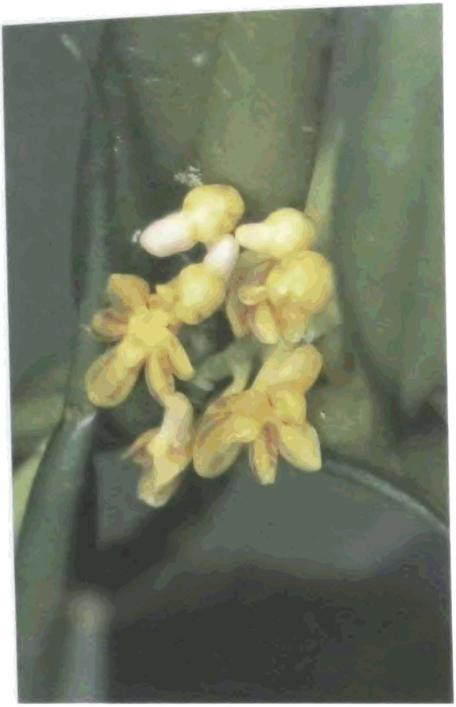


Cleisostoma linearilobulatum. Cult. R.B.G.E. ex Bhutan. K. Grant

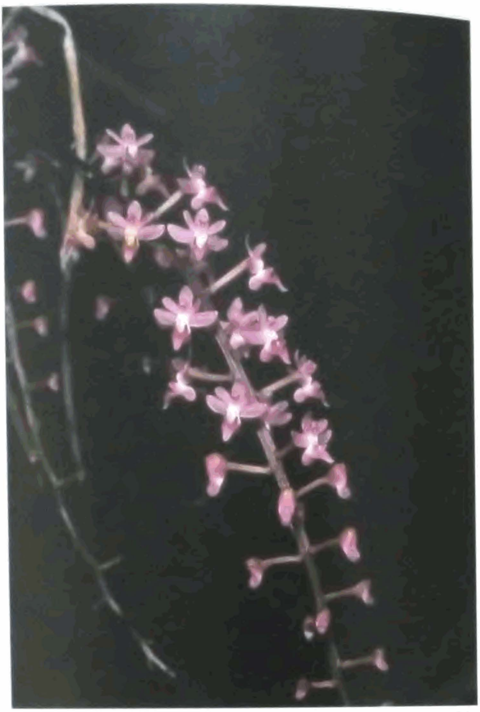


Cleisostoma racemiferum. Cult. R.B.G.E. ex Bhutan. K. Grant

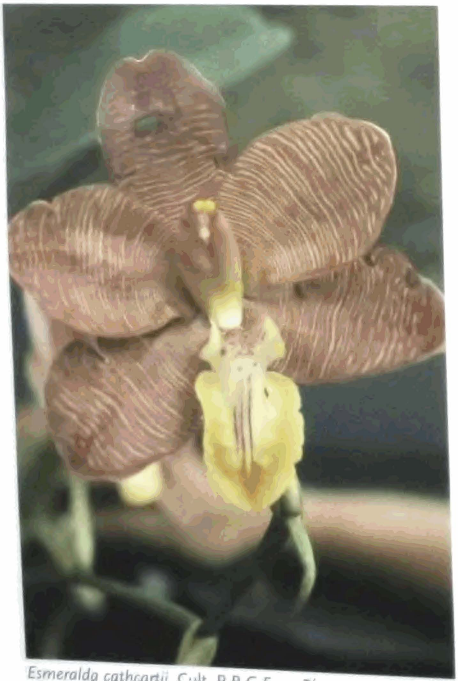
PLATE 28



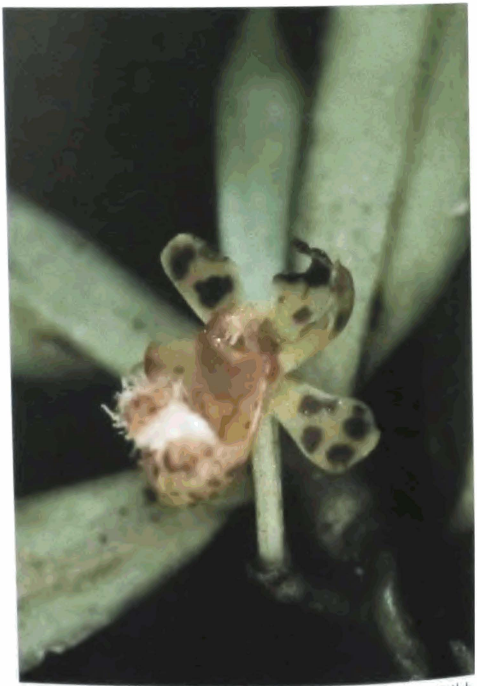
Cleisostoma subulatum. Cult. R.B.G.E. ex Bhutan. K. Grant



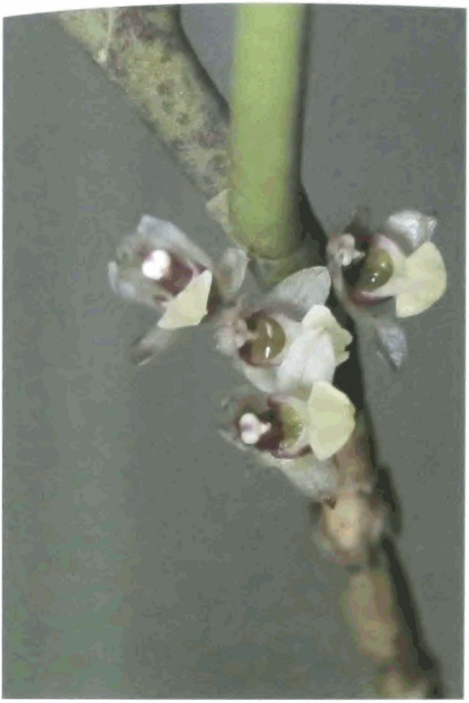
Cleisostoma williamsonii. Bhutan. P.J. Cribb



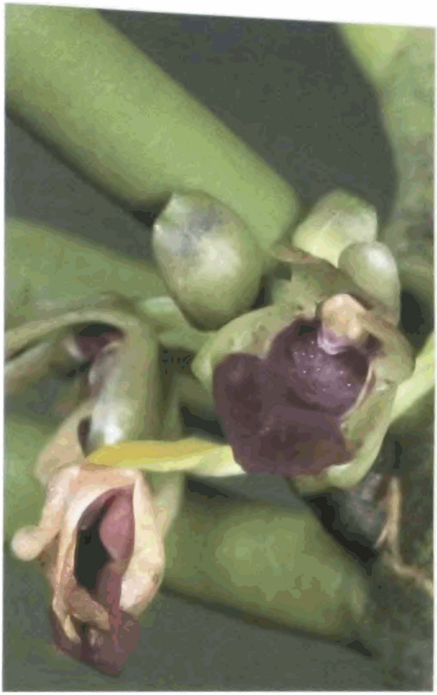
Esmeralda cathcartii. Cult. R.B.G.E. ex Bhutan. K. Grant



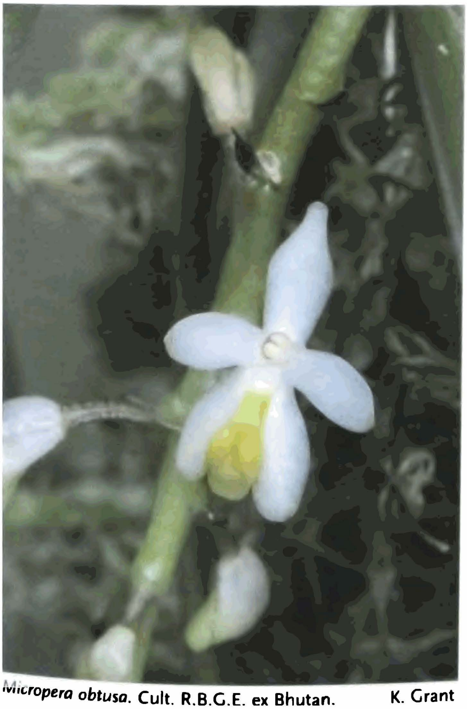
Gastrochilus acutifolius. Guangxi, China. P.J. Cribb



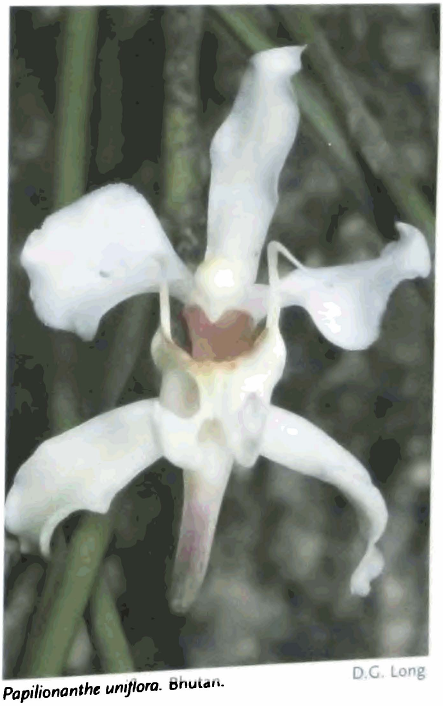
Gastrochilus inconspicuus. Cult. R.B.G.E. ex Bhutan.
K. Grant



Luisia zeylanica. Cult. R.B.G.E. ex Bhutan. K. Grant

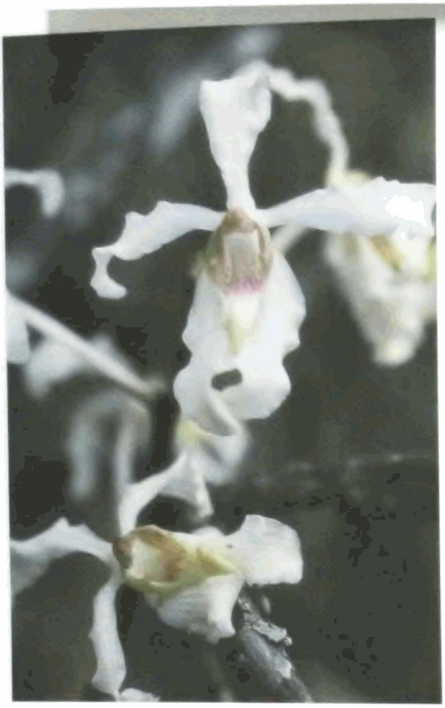


Micropera obtusa. Cult. R.B.G.E. ex Bhutan. K. Grant

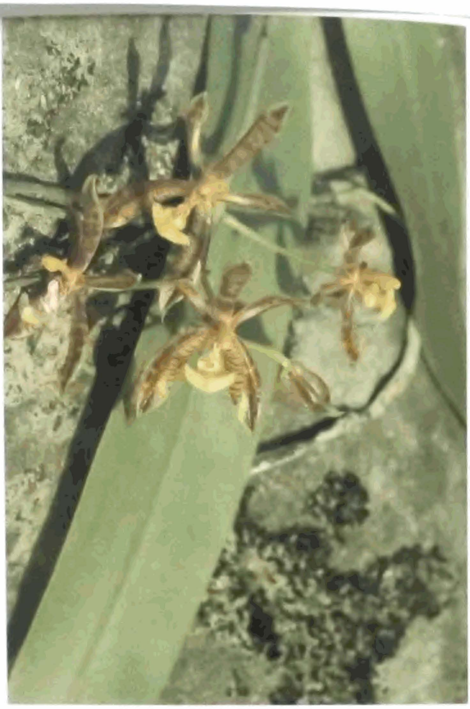


Papilionanthe uniflora. Bhutan. D.G. Long

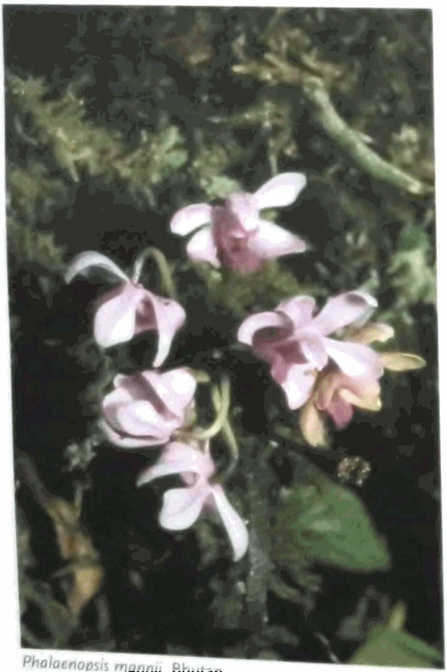
PLATE 30. The photograph labelled *Papilionanthe vandarum* actually shows *Vandopsis undulata*. The specific names *taenialis* and *mannii* in the photographs top right and bottom left should be reversed.



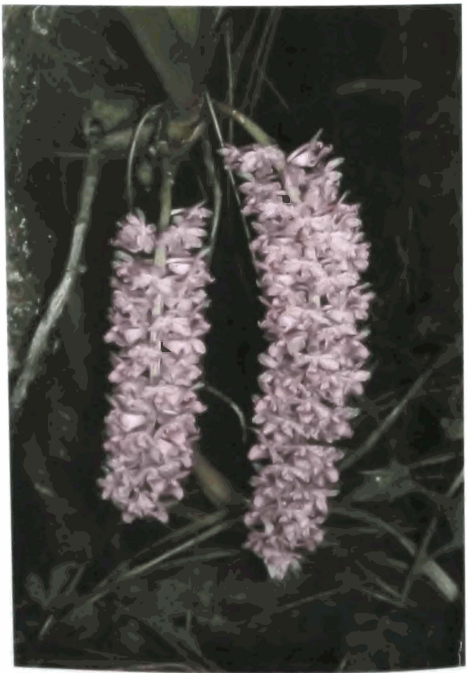
Papilionanthe vandarum. Bhutan. L. Baldock



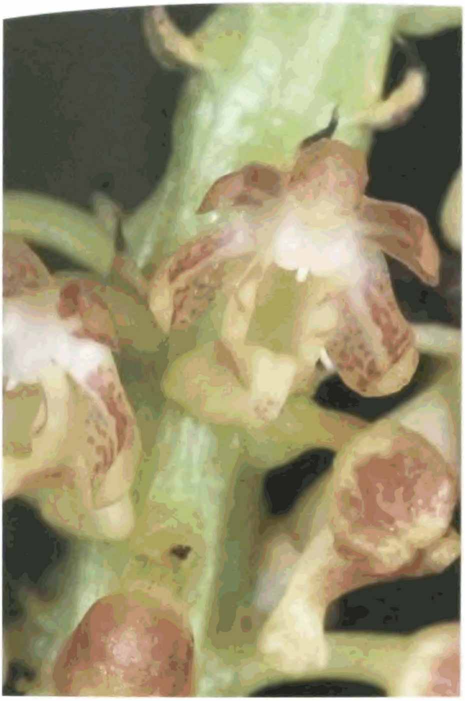
Phalaenopsis taenialis. Bhutan. A.J.C. Grierson



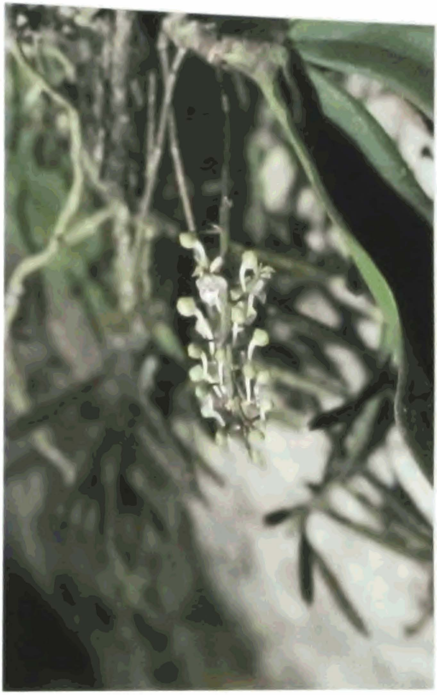
Phalaenopsis mannii. Bhutan. P.J Cribb



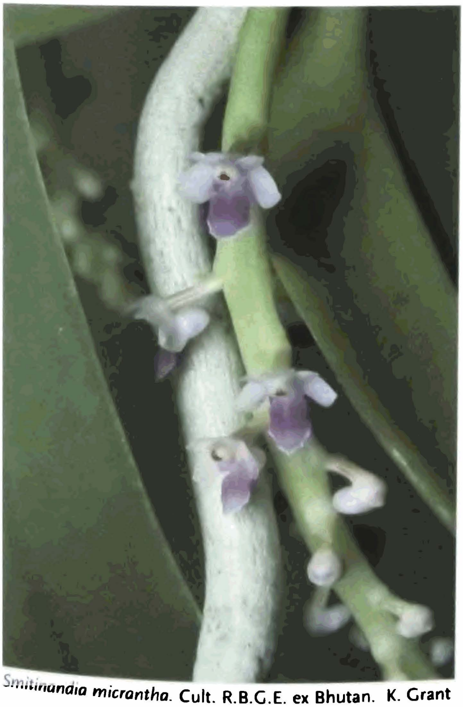
Rhynchostylis retusa. Bhutan. P.J. Cribb



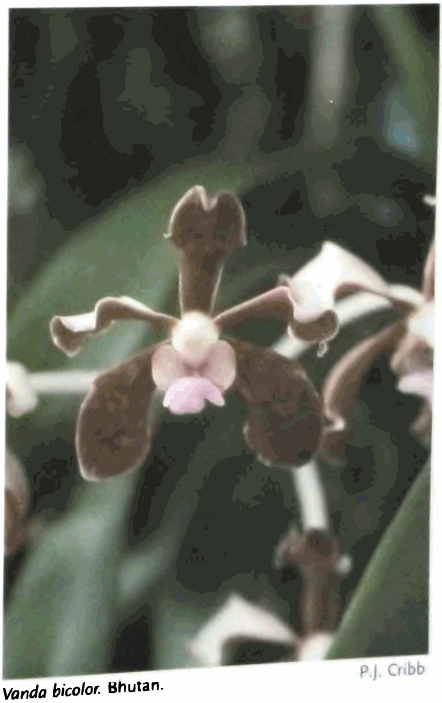
Robiquetia spatulata. Cult. R.B.G.E. ex Bhutan. K. Grant



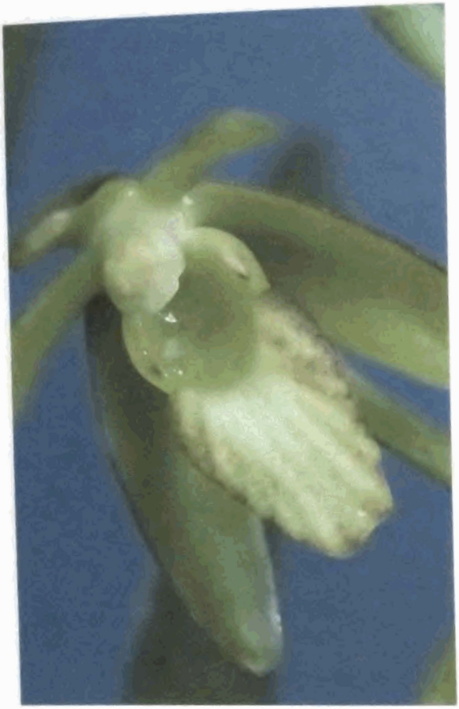
Saccolabiopsis pusilla. Cult. R.B.G.E. ex Bhutan. K. Grant



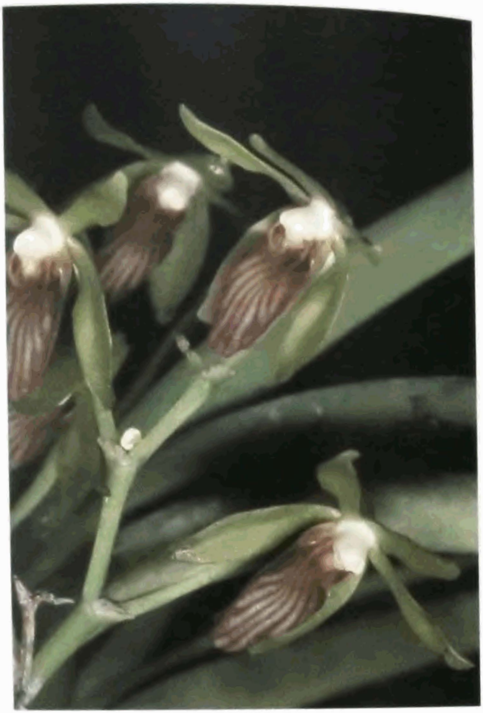
Smitinandia micrantha. Cult. R.B.G.E. ex Bhutan. K. Grant



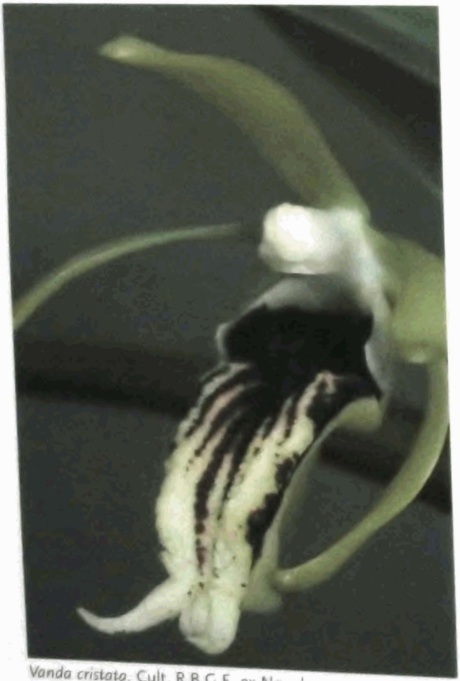
Vanda bicolor. Bhutan. P.J. Cribb



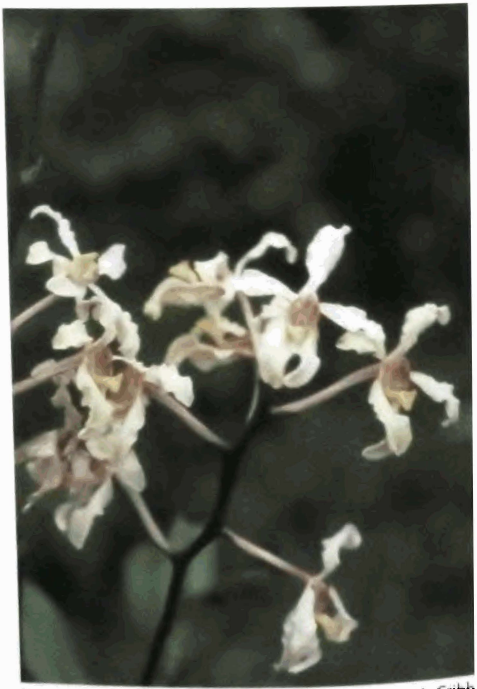
Vanda alpina. Cult. R.B.G.E. ex Bhutan. K. Grant



Vanda griffithii. Bhutan. P.J. Cribb



Vanda cristata. Cult. R.B.G.E. ex Nepal. K. Grant



Vandopsis undulata. Bhutan. P.J. Cribb

ETYMOLOGY. From the Latin *pannosus* (with the appearance of felt or cloth) in reference to the indumentum of the peduncle.

NOTES. Lindley based his original description on a plant imported from Singapore by Loddiges (252). There is an unlabelled sheet in the Lindley herbarium at Kew which bears a single-flowered plant and a drawing by Lindley. There is no Loddiges specimen in the collection and we suspect that this sheet is the type material. Seidenfaden (1982) discussed the taxonomy of this species.

Section **Tylostylis** Lindl. in J. Proc. Linn. Soc., Bot. 3: 50 (1859).

8. **E. discolor** Lindl. in J. Proc. Linn. Soc., Bot. 3: 51 (1859). Type: India, Sikkim, *Hooker* 168 (syn. K!); Sikkim, icon. Cathcart 168 (syn. K!).

Callostylis rigida Bl., Bijdr.: 341, t.74 (1825). Type from Java.

Liparis bidentata Griff., Not. Pl. Asiat. 3: 277 (1851); Icon. Pl. Asiat. 3: t.286, f.2 (1851). Type: NE India, Assam, Griffith 428 (holo. lost).

Tylostylis discolor (Lindl.) Hook. f. in Ann. Roy. Bot. Gard. (Calcutta) 5: 22 (1895).

Callostylis rigida subsp. *discolor* (Lindl.) Brieger in Schltr., Orchideen ed.3, 1(11–12): 749 (1981).

Plant epiphytic, 25–35cm tall; *rhizome* thick, woody, sheathed, 0.5–1cm thick; sheaths distant, c.1cm long; roots numerous, branched. *Pseudobulbs* thick, cylindric, furrowed, 10–21 × 1.2–2.5cm. *Leaves* 2–6, arising from pseudobulb apex, narrowly oblong to elliptic, emarginate at apex, sessile, base grooved, coriaceous, many-veined, 13–20 × 2–4.7cm. *Inflorescence* lateral, arising from pseudobulb apex, just below the leaf, few-flowered; peduncle erect to arching, sheathed, pubescent, 2–6cm long; sheaths, broadly ovate-elliptic, pubescent, 0.5–1.5cm apart, reflexed and overlapping towards apex, 2–9mm long; rachis softly tomentose, 1–2cm long; floral bracts broadly elliptic, pubescent, 4–5 × 2–3.5mm. *Flowers* few, tomentose externally, c.5mm long, externally dull white, internally yellow-ochre, lip with a dark purplish patch near base; pedicel and ovary softly tomentose, 4–7mm long. *Sepals* similar, oblong-elliptic, obtuse, spreading, fleshy, tomentose externally, lacking a mentum, 3–4mm long. *Petals* narrowly obovate, obtuse, spreading, subglabrous externally, 2–4mm long. *Lip* simple, mobile, broadly cordate, apiculate, clawed at base, jointed at base to column foot, c.3mm long; disc with a quadrate patch. Column long, strongly curved; foot short.

Darjeeling (Mongpu, Rangit); **Sikkim** (Gangtok). 150–1160m. *Fl.* February–June.

GENERAL DISTRIBUTION. NE India, Laos, Vietnam to Malaysia and Sumatra.

ETYMOLOGY. From the Latin *discolor* (not of the same colour) in reference to the various colours of the flowers.

NOTE. The history of the taxonomic confusion of this species was given by Seidenfaden (1982).

Section **Dendrolirium** Lindl. in J. Proc. Linn. Soc., Bot. 3: 46 (1859).

9. **E. ferruginea** Lindl. in Bot. Reg. 25: t.35 (1839), non Teijsmann & Binnenddijk (1862). Type: India, *Loddiges* s.n. (holo. K-LINDL!).

Pinalia ferruginea (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant epiphytic, 21cm tall; rhizome thick, creeping. *Pseudobulbs* stem-like, cylindric, internodes 4 or 5, branched, sheathed, 8–9 × 0.5–0.6cm. *Leaves* 2, arising from pseudobulb apex, narrowly oblong-elliptic, to elliptic, acute to subacuminate, coriaceous, petiolate, jointed, 12–18 × 1.2–3cm; petiole grooved, 1.6–2cm long. *Inflorescence* arising from pseudobulb base, racemose, laxly 5- to 10-flowered; peduncle tomentose, sheathed, 8–12cm long; sheaths lanceolate, acuminate, tomentose, 1.4–1.8 × 0.4–0.6cm; rachis tomentose, 4cm long; floral bracts ovate, acute, tomentose, reflexed, 1 × 0.5cm. *Flowers* 2–2.9cm, yellowish-green to whitish, washed with purple-pink, lip white with red-purple spotting; pedicel and ovary brown-tomentose, 2–2.6cm long. *Sepals* 1.1–1.7 × 0.6–0.7cm; dorsal sepal oblong, obtuse; lateral sepals ovate, subacute, 9-veined, connate at base. *Petals* obovate, obtuse to subacute, 1.2–1.4 × 0.5–0.6cm. *Lip* 3-lobed, clawed, saccate-excavate at base, 1–1.2 × 1.3–1.4cm; lateral lobes short, round to subquadrate, retuse; mid-lobe transversely oblong, broadly 2-lobed; disc with 2 thick, crested-dentate lamellae, converging from the lateral lobes. *Column* broad, 0.8–1.4cm long (with foot). *Fruit* 5–6 × 0.8–1cm.

Bhutan: C – Punakha (between Wangdi Phodrang and Chirang) and Mongar (Thrumsing La) districts. On *Quercus griffithii*, S-facing slopes; 800–1800m. Fl. May–June.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Latin *ferrugineus* (rusty) in reference to the tomemtose covering of the inflorescence.

NOTES. This species has not previously been recorded from Bhutan. It is related to E. *tomentosa* (König) Hook. f. but that species has fatter pseudobulbs, is more densely tomentose and has a differently shaped lip.

10. E. **lasiopetala** (Willdenow) Ormerod in Opera Botanica 124: 22 (1995). Type: Thailand, Phuket, König s.n. (holo. not located).

Epidendrum flos aeris ? König in Retzius, Observ. Bot. 6: 64 (1791).

Aerides lasiopetala Willdenow, Sp. Pl. ed.4(1): 130 (1805).

Epidendrum lasiopetalum (Willdenow) Poiret in Lamarck, Encycl. suppl. 1(1): 384 (1810).

Dendrobium pubescens Hook., Exot. Fl.: t.124 (1825). Type: India, cult. Shepherd, 1820, *Wallich* s.n. (holo. K!).

D. albidotomentosum Bl., Bijdr.: 345 (1825). Type from Java.

Octomeria pubescens (Hook.) Sprengel, Syst. Veg. ed.16(4): 310 (1827).

O. flava Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 65 (1830), *nom. nud.*

Eria flava Lindl., *loc. cit.* (1830). Type: Nepal, Nawakot, coll. *Wallich* Wall. Cat. 1973.1 (holo. K!, iso. K-W!).

E. albidotomentosa (Bl.) Lindl., *op. cit.* 66 (1830).

E. pubescens (Hook.) Lindl. ex Loudon, Hort. Brit.: 372 (1830).

E. pubescens (Hook.) Lindl. ex Steudel, Nomencl. Bot. 2(1): 566 (1840), *isonym*

Pinalia albidotomentosa (Bl.) Kuntze, Revis. Gen. Pl. 2: 678 (1891).

P. pubescens (Hook.) Kuntze, *loc. cit.* (1891).

Plant epiphytic, 22–26cm tall; *rhizome* woody, sheathed; sheaths overlapping, tubular, 1–1.5cm long. *Pseudobulbs* borne at intervals of 4–5cm along rhizome, fusiform-ellipsoid, laterally compressed, furrowed, basally sheathed, 8–10 × 2–4cm; sheaths membranous, 4 × 1.5cm. *Leaves* 2–5, lanceolate-oblong, acute to acuminate, petiolate, 15–20 × 2–4cm; petiole grooved, 1–3.5cm long. *Inflorescence* lateral, arising from pseudobulb base, erect, racemose, subdensely 7- to 12-flowered; peduncle softly white-tomentose, sheathed at base, 2–5cm long; sheaths overlapping, ovate, acute, 0.5–1cm long; rachis softly white-tomentose, 8–15cm long; floral bracts lanceolate, acute, persistent, 0.8–1.8 × 0.3–0.4cm. *Flowers* 1–1.3cm long, green to yellow, lip with crimson-purple; pedicel and ovary tomentose, 1–3.5cm long. *Sepals* subsimilar, tomentose externally; dorsal sepal lanceolate, 1.1–1.3 × 0.4–0.5cm; lateral sepals lanceolate, spreading, triangular, acute, long-tomentose at apex, 1.1–1.3 × 0.4–0.5cm. *Petals* elongate-oblong, parallel to column, 7–8 × 2–3mm. *Lip* 3-lobed, 1–1.3 × 0.4–0.6cm; lateral lobes short, truncate; mid-lobe oblong, acute, recurved; disc at base with 2 calluses. *Column* 4–5mm long. *Fruit* narrowly fusiform, ridged, 3–4.5 × 0.3–0.4cm. **Plate 18.**

Bhutan: S – Sarbhang (Singi Khola 10km SW of Sarbhang) and Gaylegphug (between Lodrai Khola and Aie bridge) districts; **Terai** (Dalkajhar); **Duars** (unlocalised *Haines* specimen); **Darjeeling** (near Gahribans, Rayeng); **Sikkim** (Great Rangit River). Subtropical terai forest on river bank; 390–660m. Fl. February–April(–August); Fr. August.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China, Thailand, Laos, Cambodia and Vietnam.
ETYMOLOGY. From the Greek *lasio-* (woolly) and *petalon* (petal/sepal).
NOTES. This species has more commonly been known under the names *E. flava* and *E. pubescens*. The name used here was proposed by Seidenfaden (1995b) and is based on an examination of the collections of J.G. König.

This species is related to *E. tomentosa* (König) Hook. f., which has been reported from Khasia and Assam, but differs in that the pedicel, ovary and sepals are greyish-yellowish tomentose rather than light-brown tomentose. Chowdhery (1998) reported *E. tomentosa* from the Kameng district of Arunachal Pradesh but we are unable to confirm this report.

There has been, and remains, considerable confusion about the identities of this species and the closely related *E. laniceps* Rchb. f., *E. albidotomentosa* (Bl.) Lindl. and *E. lanata* Griff. Seidenfaden (1982) discussed the problems in depth and treated them as distinct species. In his key he stated that the inflorescences are often two together for *E. laniceps* but that this was a variable feature not present in the type specimen. He also noted that *E. laniceps* flowered in February and *E. pubescens* flowered in (September–)November but he listed plants from Sikkim under *E. pubescens* which flowered in February. The other features included in the key are minor differences in floral size and characters that do not help to separate these plants. Several authors, Hooker (1890), King & Pantling (1898), Bechtel *et al.* (1992), have treated *E. laniceps* within the synonymy of *E. pubescens*. We have examined the specimens from our area and find it impossible to distinguish them (see note under *E. laniceps* below in 'doubtful species').

Hooker (1890) treated *E. lanata* as a variety of *E. flava* and commented that the flowers were smaller, the lip narrower and the mid-lobe purplish with thickened veins on the lip. The type was based on Griffith 810 from Mergui which is at Kew. He included a Hooker collection from Sikkim which is referable to *E. lasiopetala*. Seidenfaden (1982) maintained it as distinct because of the short (1–2mm) mesochile. We have not found this species in our area.

It is beyond the scope of this book to resolve the problems and we refer all the local material to *E. lasiopetala*.

Section **Mycaranthes** Rchb. f. in Bonplandia 5: 55 (1857).

11. E. paniculata Lindl. in Wall., Pl. Asiat. Rar. 1: 32, t.36 (1830). Type: Bangladesh, Pandua, coll. F. *De Silva* Wall. Cat. 1971 (holo. K-LINDL!, iso. BM! K! K-W! W!).
Dendrobium floribundum D. Don, Prodr. Fl. Nepal.: 34 (1825). Type: Nepal, *Wallich* s.n. (holo. BM!).
Pinalia paniculata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant terrestrial or epiphytic, 30–40cm tall. *Stems* caespitose, pendent, woody, covered in sheaths, 5–6mm thick; sheaths tubular, 2–4cm long. *Leaves* many along stem, linear to linear-oblong, acuminate, fleshy, subsessile to shortly petiolate, jointed, sheathing at base, 9–27 × 0.2–1cm. *Inflorescences* 2–4, terminal, fasciculate to paniculate, densely many-flowered; peduncle sheathed, woolly-pubescent, 3.5–8cm long; sheaths long-lanceolate; rachis woolly-pubescent, 4–23cm long; floral bracts lanceolate, acuminate, falcate, glabrous, reflexed, 4–8 × 2–2.5mm. *Flowers* acrid-scented, 3–5mm across; sepals pale yellowish-green, petals, lip and column pale lavender with brownish-purple blotches, lip callus white; pedicel and ovary woolly-pubescent, 3–7mm long. *Sepals* 3–5 × 2–2.5mm; *dorsal sepal* ovate; *lateral sepals* triangular, weakly falcate, spreading, puberulent externally. *Petals* elliptic-obovate, margins weakly erose, 3–4 × 1.5–2mm. *Lip* 3-lobed, 3–4 × 2–4.2mm (across base); lateral lobes oblong, weakly falcate, subacute, porrect; mid-lobe broadly suborbicular, decurved, margins erose; disc 2-callose; basal callus round, and with a large, cylindric callus from base to apex, both mealy. *Column* stout, c.3mm long; foot narrow. *Fruit* narrowly cylindric, 1–1.9 × 0.15–0.25cm. **Plate 18.**

Bhutan: S – Chukka (Marichong) and Gaylegphug (Surelakha, 15km N of Gaylegphug) districts; C – Punakha district (Bhotokha, Chusom (field record), Khosa, Rimchu); **Darjeeling** (unlocalised Elwes and *Gamble* specimens); **Sikkim** (Tumlang). In tropical valleys, on branches of trees in dense forest; 660–2330m. Fl. January–May.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand, Laos, Cambodia and Vietnam.
ETYMOLOGY. From the Latin *paniculatus* (paniculate) in reference to the inflorescence.
NOTE. Ormerod (2000) discussed the synonymy of this species.

Section **Secundae** Leavitt in Philipp. J. Sci. 4(3): 217 (1909).

12. **E. stricta** Lindl., Coll. Bot. 8: t.41b (1826). Type: Nepal, Thoka, coll. *Wallich* Wall. Cat. 1970 (holo. K-LINDL!, iso. K! K-W!).
Mycaranthes stricta (Lindl.) Lindl., Gen. Sp. Orchid. Pl.: 63 (1830).
Eria secundiflora Griff., Not. Pl. Asiat. 3: 302 (1851); Icon. Pl. Asiat. 3: t.302 (1851). Type: India, Darjeeling, *Griffith* 5118 (syn. K!); Khasia, *Griffith* 5119 (syn. K!)..
Pinalia stricta (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant epiphytic, 14–30cm tall; *roots* linear, branching. *Pseudobulbs* crowded, often cohering, cylindric, bases covered with fibrous sheaths, 7–14.5 × 0.3–0.5cm; sheaths membranous, 2–3cm long. *Leaves* 2, arising from pseudobulb apex, oblong-elliptic, acute, shortly petiolate, 7.5–11 × 1–2.1cm; petiole grooved, c.5mm long. *Inflorescence* 1, erect, arising from pseudobulb apex (between leaves), racemose, usually secund, densely many-flowered; peduncle glabrous, 2–8cm long; rachis 5.5–11cm long; floral bracts ovate, acute, glabrous, c.1 × 0.5mm. *Flowers* densely woolly externally, 2–4mm long, white, flushed with pink, lip white streaked with yellow, column yellow; pedicel and ovary densely woolly, 4–5mm long. *Sepals* similar, densely woolly externally, ovate, 2–3 × 1–1.5mm. *Petals* ovate-orbicular, obtuse, 2–3 × 1–1.5mm. *Lip* suborbicular, concave, obscurely 3-lobed; base gibbous, 2–3mm long; lateral lobes shallow, rounded; mid-lobe very short, broad, truncate; disc with small, depressed callus. *Column* broad, c.1mm long; foot short. **Plate** 19.

Bhutan: S – Gaylegphug district (Karai Khola, above Aie bridge); **Duars** (unlocalised *Haines* specimen); **Darjeeling** (Dumsong, below Kurseong); **Sikkim** (Gangtok). In subtropical valleys, on *Gordonia* sp.; 330–1800m. Fl. November–April.

GENERAL DISTRIBUTION. NE India and Myanmar.
ETYMOLOGY. From the Latin *strictus* (upright, straight).
NOTES. Seidenfaden & Smitinand (1959–65) treated E. *siamensis* Schltr. as a synonym of E. *stricta*, but Seidenfaden (1982) later concluded that they were distinct. E. *siamensis* has triangular, acuminate-acute floral bracts while those of E. *stricta* are smaller; the petals of E. *siamensis* are half as wide and the lip is different.

Section **Cylindrolobus** Bl., Mus. Bot. 2: 182 (1856).

13. **E. biflora** Griff., Not. Pl. Asiat. 3: 302 (1851). Type: Myanmar (Burma), Mergui, *Griffith* 830 (holo. K-LINDL!).
Eria choneana Kränzlin in Bot. Jahrb. Syst. 8: 203 (1886). Type without provenance.
Pinalia biflora (Griff.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).
Cylindrolobus biflorus (Griff.) Rauschert in Feddes Repert. 94(7–8): 445 (1983).

Plant epiphytic, 10–18cm tall; *roots* clustered. *Pseudobulbs* clustered, contiguous, clavate (linear at base), compressed, sheathed, 4–10 × 0.3–0.5cm (at apex); sheaths membranous, lanceolate, 1.5–2.4cm long. *Leaves* 2–4, arising from pseudobulb apex, narrowly elliptic, subacute to acute, prominently 1-veined, tapering at base to short petiole, jointed, 4–6 × 0.5–0.9cm; petiole grooved, 2–4mm long. *Inflorescence* short, racemose, arising from leaf axils, 2- or 3-flowered; peduncle short, compressed, glabrous, c.2mm long; floral bracts elliptic, recurved, petaloid, yellow, 4–6 × 2–3mm. *Flowers* 2–3mm long, pale yellow; pedicel and ovary 2–3mm long. *Sepals* connivent at base, subsimilar, narrowly elliptic, acute, 3–4mm long; *lateral sepals* falcate; *mentum* triangular, 1–1.5mm long. *Petals* oblong, obtuse, 2–3mm long. *Lip* entire to obscurely 3-lobed, oblong to subpandurate in outline, hinged to column foot, 2–3.5mm long; lateral lobes short to obscure, incurved; mid-lobe oblong, obtuse, emarginate, margins papillose; disc with 2 erect laminae at base and a central, oblong callus at apex. *Column* broad at base, c.1–1.5mm long.

Sikkim (unlocalised *Pantling* specimen). In tropical valleys. Fl. September.

GENERAL DISTRIBUTION. NE India, Myanmar, Thailand, SE Asia, Malaysia, Sumatra and Java.
ETYMOLOGY. From the Latin *bi-* (two) and *flos* (flower).

Section **Bambusifolia** Hook. f., Fl. Brit. India 5(2): 786 (1890).

14. **E. bambusifolia** Lindl. in J. Proc. Linn. Soc., Bot. 3: 61 (1859). Types: India, Khasia Hills, *Simonds* 64 (syn. K-LINDL!); Khasia Hills, *Griffith* s.n. (syn. K-LINDL!).
Pinalia bambusifolia (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant epiphytic, 30–50cm tall. *Stem* elongate, thick, covered in tubular sheaths, c.40 × 0.5–1.5cm; sheaths obtuse, broadly ovate, 2–4cm long. *Leaves* 7–10, alternate at top of stem, narrowly elliptic-oblong, acuminate, many-veined, tapered to a sheathing base, 13–22 × 2.3–4.6cm. *Inflorescence* apical, racemose to subpaniculate, lax; peduncle sheathed, reddish-pubescent, 3–5cm long; sheaths broadly ovate, obtuse, 6–7mm long; rachis reddish-pubescent, 16–18cm long; floral bracts broad, suborbicular, apiculate, 6 × 3.5mm. *Flowers* distant, c.1cm long, pale brown with darker lines, lip lamellae pale green, column yellow and pink; pedicel and ovary reddish, 1.5–2cm long. *Sepals* reddish externally, 5-veined, spreading, 0.9–1.2 × 0.3–0.4cm; *dorsal sepal* elliptic, obtuse; *lateral sepals* falcate, connate to form a short mentum; *mentum* 3–5mm long. *Petals* elliptic-oblong, obtuse, 3-veined, spreading, 7–9 × 2–3mm. *Lip* obscurely 3-lobed, 6–8 × 5–6mm; lateral lobes small; mid-lobe ovate-oblong, obtuse, deflexed below the middle; disc 3-lamellate, from base to apex, pubescent. *Column* curved, 5–9mm long; foot straight. *Fruit* cylindric, slender, 3–4 × 0.2–0.4cm.

Darjeeling (Rississum); **Sikkim** (unlocalised *Hooker* specimen). 3000m. Fl. October.

GENERAL DISTRIBUTION. India, Myanmar, China (Yunnan) and Thailand.
ETYMOLOGY. From the Latin *bambusa* (bamboo) and *-folius* (leaved).

Section **Hymenaria** Lindl. in J. Proc. Linn. Soc., Bot. 3: 52 (1859).

15. **E. acervata** Lindl. in J. Hort. Soc. London 6: 57 (1851). Type: "Presented by...Directors of the East India Company" cult. (holo. not found); Lectotype (selected here): [icon. in] J. Hort. Soc. London 6: 57 (1851)!
Pinalia acervata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).
Eria poilanei Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 2: 310 (1930). Type from Cambodia.

Plant epiphytic or lithophytic, 12–20cm tall. *Pseudobulbs* compressed, flask-shaped to ellipsoid, stacked to clustered, furrowed, sheathed when young, 3–5 × 0.9–2cm; sheaths membranous-fibrous, lanceolate, 2–5cm long. *Leaves* 2–6, narrowly oblong to oblanceolate-oblong, obtuse-emarginate, tapered towards base, petiolate, 5.5–16 × 0.9–2cm; petiole grooved, 0.5–4cm long. *Inflorescence* 1–3, laxly few-flowered; peduncle puberulous, sheathed, 1–2cm long; sheaths 4 or 5, lanceolate, reflexed, 1–1.5cm long; rachis glabrous, 3–4.5cm long; floral bracts lanceolate, acuminate, 3-veined, 0.9–1.7 ×

0.3–0.6cm. *Flowers* glabrous, 1–1.2cm long, white, sepals tinged with green at apex, lip tinged with yellow; pedicel and ovary slender, glabrous, 0.9–1.2cm long. *Sepals* subsimilar, lanceolate, acuminate, 7–8 × 3–4cm; *lateral sepals* falcate. *Petals* narrowly lanceolate, 7–8 × 2–3mm. *Lip* 3-lobed, obovate, 6–7mm long; lateral lobes oblong, obtuse; mid-lobe suborbicular to ovate, margins entire; disc with 3 narrow, parallel ridges from base to near apex; *mentum* c.3mm deep. *Column* 3–4mm long; foot 2–3mm long.

Bhutan: C – Tongsa (Tingtinbi (field record), Tongsa) and Mongar (between Mongar and Saling) districts; **Darjeeling/Sikkim** (Tista River Valley); **Sikkim** (Zema). On trees or rocks on wet northern slopes; 330–3000m. Fl. April–August.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand, Laos, Cambodia and Vietnam.
ETYMOLOGY. From the Latin *acervatus* (heaped) in reference to the stacked pseudobulbs.

16. **E. alba** Lindl., Gen. Sp. Orchid. Pl.: 67 (1830). Type: Nepal, Sheopore, *Wallich* s.n. (holo. K-LINDL!).
Octomeria alba Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 67 (1830), *nom. nud.*
Pinalia leucantha Kuntze, Revis. Gen. Pl. 2: 679 (1891), *nom. alt.*

Plant epiphytic, 10–20cm tall. *Pseudobulbs* ovoid to flask-shaped, clustered, ranked, 1–3 × 0.4–1cm. *Leaves* 2–6, linear-lanceolate, acuminate, narrowed and petiolate at base, 9–15 × 0.5–2cm; petiole grooved, 1–2cm long. *Inflorescence* terminal, erect, racemose, laxly 5- to 8-flowered; peduncle short, pubescent, 2–3cm long; rachis pubescent, 3–4cm long; floral bracts short, ovate, acute, 4–5 × 2–2.5mm. *Flowers* 0.8–1cm long; sepals and petals white, lip yellow with purple edges to lateral lobes; pedicel and ovary slender, pubescent, 5–6mm long. *Sepals* subsimilar, spreading, elliptic-lanceolate, pubescent externally, 0.7–1.1 × 0.2–0.4cm; *lateral sepals* weakly falcate. *Petals* oblong, subacute, 6–9 × 1.5–2.5mm. *Lip* 3-lobed, fleshy, clawed at base, 0.7–1.1cm long; lateral lobes triangular-oblong, obtuse, erect-incurved; mid-lobe oblong-orbicular, entire; disc with 2 thick ridges. *Column* lacking a foot, 4–9cm long. *Fruit* ellipsoid, 1.5–1.8 × 0.3–0.4cm. **Plate** 17.

Bhutan: C – Tashigang district (Chorten Kora, Dalingmang, Tashi Yangtsi Dzong); **Darjeeling** (unlocalised *Treutler* specimen); **Sikkim** (unlocalised *Hooker* specimen). Growing on *Quercus griffithii* and in *Pinus wallichiana* and mixed riverine forest; 1000–2330m. Fl. April–June.

GENERAL DISTRIBUTION. Nepal, India (Himalayas).
ETYMOLOGY. From the Latin *albus* (white) in reference to the flower colour.

17. **E. amica** Rchb. f., Xenia Orchid. 2: 162, t.168 (1870). Type: India, Assam, *Day* s.n. (holo. W not found); Lectotype (selected here): [icon. in] J. Day, Drawings of Orchids 11: t.63 (1866)!
Eria confusa Hook. f., Ic. Pl. t.1850 (1889). Types: India, Sikkim, *Hooker* 61 (syn. K!); Nepal, coll. *Wallich* Wall. Cat. 1974 p.p. (syn. K!).
E. andersonii Hook. f., Fl. Brit. Ind. 5(2): 795 (1890); Ic. Pl. 21: t.2069 (1892). India, Darjeeling, icon. *Anderson* (holo. CAL).
Pinalia amica (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).
P. andersonii (Hook. f.) Kuntze, loc. cit. (1891).
P. confusa (Hook. f.) Kuntze, loc. cit. (1891).
Eria hypomelana Hayata, Icon. Pl. Formos. 4: 54, t.22 (1914). Type from Taiwan.

Plant epiphytic, 12–27cm tall. *Pseudobulbs* superposed, erect-cylindric, sheathed at base, 4–17 × 0.7–1.5cm; sheaths 1–2cm long. *Leaves* 2, arising from pseudobulb apex, linear-lanceolate to oblong-lanceolate, acute, tapered to petiolate base, 7–21 × 0.8–2cm; petiole grooved, 0.6–2cm long. *Inflorescence* arising from axils of leaf-sheaths, 1–3 from each pseudobulb, erect to suberect, laxly 6- to 12-flowered; peduncle slender, 3–4cm long; rachis slender, pubescent, 5–6cm long; floral bracts oblong-lanceolate, subacute, reflexed, 0.7–1.5cm long. *Flowers* 7–9mm across; sepals and petals buff-yellow to greenish-yellow with red veins and yellow apices, lip pink with bright yellow apex and red lateral lobes and keels; pedicel and ovary slender, pubescent, 1.5–2.5cm long. *Sepals* subsimilar, 0.8–1cm long; *dorsal sepal* lanceolate, acute; *lateral sepals* lanceolate, oblique, connate at base to form a mentum with the column; *mentum* pubescent externally, 4–6mm long. *Petals* linear-lanceolate, acute, 6–8mm long. *Lip* 3-lobed, shortly clawed, 0.8–1 × 0.7–0.8cm; lateral lobes erect, triangular, obtuse to subacute; mid-lobe transversely oblong to elliptic, retuse to 2-lobed, lobes broad, rounded; disc with 3 low keels. *Column* incurved, 3–4mm long; foot 2–3mm long.

Bhutan: C – Punakha (near Nahi) and Tongsa (Tama (M.F.B.)) districts; (unlocalised cult. specimen); **Duars** (unlocalised *Hooker* specimen); **Sikkim** (Pemayangtse, Temi, Tista River). 500–1600m. Fl. March–May.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China, Thailand and Vietnam.
ETYMOLOGY. From the Latin *amica* (a female friend) but reference obscure.
NOTES. John Day received the type specimen from his nephews W. and C. Williamson in Assam and illustrated the species in his sketchbook (Vol. 11, t.63) which is at Kew. Another good illustration of this species can be found in Summerhayes (1936) who also discussed the taxonomy.

18. E. bractescens Lindl. in Bot. Reg. 27: misc.18, no.46 (1841). Types: Singapore, *Loddiges* 214 (syn. K, not found); Myanmar, *Griffith* 1055 (syn. K-LINDL!).

E. pulchella Griff., Not. Pl. Asiat. 3: 297 (1851). Type: Myanmar (Burma), Mergui, *Griffith* 1055 (holo. K-LINDL!).

E. griffithii Rchb. f., Xenia Orchid. 2: 163 (1870). Type: Myanmar (Burma), Mergui, *Griffith* s.n. (holo. K-LINDL!).

Pinalia bractescens (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

P. pulchella (Griff.) Kuntze, *loc. cit.* (1891).

Plant epiphytic, 12–25cm tall. *Pseudobulbs* clustered, narrowly cylindric-conical, wrinkled, internode single, 4–9 × 0.9–1.6cm (at base). *Leaves* 2–6, elliptic-oblong, subacute, subcoriaceous, 9-veined with a strong central vein, tapered into petiole, 10–15 × 0.8–2.5cm; petiole grooved, c.1cm long. *Inflorescences* 2, arising from pseudobulb apex, racemose, laxly 7-flowered; peduncle sheathed at base, glabrous, 2–2.5cm long; sheaths ovate, acute, membranous, 6 × 4mm; rachis glabrous, 5–6cm long; floral bracts elliptic-ovate, reflexed, margins involute, 0.6–1.1 × 0.2–0.35cm. *Flowers* glabrous, 0.7–1.3cm long, pale yellow to greenish, lip lateral lobes red; pedicel and ovary glabrous, 0.7–1cm long. *Sepals* similar, spreading, elliptic, subacute, 0.5–1 × 0.18–0.3cm. *Petals* narrowly oblong, obtuse, revolute, 6–8 × 1.5–2mm. *Lip* 3-lobed, 5 × 4–5mm; lateral lobes erect, large, rounded; mid-lobe oblong, entire, deflexed at apex; disc 3-lamellate, the 2 lateral lamellae dilated towards base, margins glandular, the central lamella papillose at base. *Column* stout; foot short. *Fruit* ellipsoid to fusiform, 2–3 × 0.3–0.4cm. 381

Sikkim (unlocalised *Pantling* specimen). 330–1000m. Fl. April.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia, the Philippines and New Guinea.
ETYMOLOGY. From the Latin *bracteatus* (with bracts).

19. E. excavata Lindl., Gen. Sp. Orchid. Pl.: 67 (1830). Type: Nepal, Sheopore, coll. *Wallich* Wall. Cat. 1974 p.p. (holo. K-LINDL!, iso. K! K-W!).

Octomeria excavata Wall. in Lindl., Gen. Sp. Orchid. Pl.: 67 (1830), *pro. syn.*

Eria flava var. *rubida* Lindl. in J. Proc. Linn. Soc., Bot. 3: 49 (1859). Type: India, Sikkim, icon. Cathcart (holo. K-LINDL!).

E. sphaerochila Lindl., *op. cit.* 54 (1859). Type: India, Khasia, *Hooker* 68 (K-LINDL!).

Pinalia excavata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant epiphytic or lithophytic, 13–20cm tall. *Pseudobulbs* cylindric, tapering at each end, compressed, rugose, ranked, 1–3.5 × 0.2–0.5cm. *Leaves* 4–6, oblong-lanceolate to elliptic-lanceolate, acute, overlapping at base, membranous, many-veined, petiolate, 9–14 × 1–1.5cm; petiole grooved, 1–2cm long. *Inflorescence* 1, terminal, erect to slightly decurved, racemose, laxly 6- to 12-flowered; peduncle sheathless, pubescent, 2.5–5cm long; rachis reddish-pubescent, c.5cm long; floral bracts, lanceolate, long-acuminate, glabrous, 7–9 × 1–2mm. *Flowers* 0.5–1cm across, pale cream, lip with yellow-red markings; pedicel and ovary reddish-pubescent, 0.6–1cm long. *Sepals* subsimilar, 3-veined, pubescent externally, connivent, 5–6mm long; *dorsal sepal* elliptic-lanceolate, acute; *lateral sepals* ovate-lanceolate, subacute, falcate. *Petals* lanceolate, obtuse, 3-veined, 5–6mm long. *Lip* 3-lobed, sessile, 4–6 × 3–4mm; lateral lobes erect, rounded; mid-lobe decurved, transversely oblong-cordate, apex acute, occasionally emarginate; disc with variable calluses, usually 2-callose basally, warty-rugulose in mid-lobe. *Column* excavate (in dried specimens), c.2mm long. *Fruit* ellipsoid, 1.3–1.9 × 0.3–0.6cm. **Plate 17.**

Bhutan: S – Chukka district (between Jumudag and Tala); C –Punakha district (Lometsawa, Phang Yue, near Wangdi Phodrang); **Darjeeling** (Senchal); **Sikkim** (Dentam to Pemayangtse, Penlang La). In warm forest on steep hillside, on *Quercus griffithii*; 1000–2330m. Fl. May–June; Fr. October–February.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Latin *excavatus* (hollowed out) in reference to the stigma of dried material.
NOTE. King & Pantling (1898) noted that the specimens gathered in Sikkim were self-pollinating and considered that this species might be a cleistogamous form of E. *alba*. They also noted that the column was not hollow in living material.

20. E. graminifolia Lindl. in J. Proc. Linn. Soc., Bot 3: 54 (1859). Type: India, Darjeeling, *Griffith* s.n. (holo. K-LINDL!).
Pinalia graminifolia (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant epiphytic or lithophytic, 18–30cm tall. *Pseudobulbs* narrowly cylindric, sheathed when young, coherent at base, 8–15 × 0.3–0.75cm; sheaths tubular, membranous-fibrous, 2–8 × 0.6–1cm. *Leaves* 2–6, linear-lanceolate to narrowly oblong-elliptic, acuminate, narrowed towards base, shortly petiolate, thickly membranous, many-veined, clustered at apex of pseudobulb, 7–15 × 0.9–2.2cm; petiole grooved, 0.8–1cm long. *Inflorescences* 2 or 3, from pseudobulb apex among young leaves, erect, racemose, laxly 10- to 15-flowered; peduncle short, glandular-pubescent, c.2cm long; rachis glandular-pubescent, 4–10cm long; floral bracts ovate-lanceolate, acuminate, apical margins fimbriate, 6–8 × 1.5–2.5mm. *Flowers* c.1cm across; sepals and petals white, lip lateral lobes red, disc ridges yellow-white; pedicel and ovary glandular-pubescent, 7–8mm long. *Sepals* subsimilar, elliptic-lanceolate, acute to acuminate, 3- to 5-veined, 0.8–1 × 0.3–0.4cm; *lateral sepals* weakly falcate. *Petals* oblong, subacute, weakly falcate, 3-veined, 7–9 × 1.5–2mm. *Lip* fleshy, 3-lobed, 5–8 × 4–5mm (across lateral lobes when spread); lateral lobes oblong, obtuse, erect, incurved; mid-lobe transversely oblong, emarginate; disc with 3 parallel ridges at base, central ridge extending into a large, oblong callus on mid-lobe. *Column* c.3.5mm long; foot stout, puberulous. *Fruit* fusiform, 0.8–1.5 × 0.2–0.25cm.

Bhutan: C – Punakha (Lometsawa (field record)) and Tashigang (between Tashi Yangtsi and Tobrang (M.F.B.)) districts; **Darjeeling** (Birch Hill, Senchal, Tonglu); **Sikkim** (Chunthang, Lema, N side of Panlang La). On cliffs and trees, by road; 2000–3320m. Fl. June–August.

GENERAL DISTRIBUTION. Nepal, NE India and Myanmar.
ETYMOLOGY. From the Latin *graminifolius* (grass-leaved).

Section **Pinalia** Lindl., Gen. Sp. Orchid. Pl.: 70 (1830).

21. E. connata Joseph, Hegde & Abbareddy in Bull. Bot. Surv. India 24(1–4): 114 (1982). Type: India, Arunachal Pradesh, Kameng district, Sessa, *Abbareddy* 62391 (holo. CAL, iso. ASSAM, MH).

Plant epiphytic; roots slender, wiry. *Pseudobulbs* erect, subcylindric, ± compressed, subclavate, nodes oblique, 5–15 × 0.7–1cm. *Leaves* 4 or 5, narrowly elliptic, weakly falcate, acuminate, distichous, sessile, 5- to 7-veined, 6–8 × 1–1.7cm. *Inflorescence* axillary or leaf-opposed, pendent, racemose, globose to subglobose, proteranthous, densely many-flowered; floral bracts broadly ovate to suborbicular, acute to acuminate, 5-veined, 6–7.5 × 5–6mm. *Flowers* fragrant; sepals and petals white, lip yellow; pedicel and ovary densely pubescent, curved, 5–6 × c.1mm. *Dorsal sepal* ovate, obtuse, hooded, 3.5–4 × 2.5–3mm; *lateral sepals* obliquely oblong-lanceolate, obtuse, adnate to sides of the column foot to form a mentum, 7–8 × 2–2.5mm. *Petals* ovate-lanceolate, obtuse, membranous, 3–4 × 1.5–2mm. *Lip* 3-lobed, narrowly oblanceolate in outline, 6–6.5 × 2–2.5mm; base weakly saccate; lateral lobes erect, narrow, apex triangular, involute; mid-lobe orbicular, small, fleshy, warty; disc 3-lamellate, lateral lamellae thick, median lamella narrow, dilated at apex. *Column* stout, erect, 1.5–2mm tall; foot 3.5–4.5mm long. *Fruit* shortly stalked, pedicellate, 6-ridged, c.1.1 × 0.3cm. **Plate 17**.

Bhutan: – (unlocalised *Grierson & Long* specimen). On trunks of trees in evergreen subtropical forest; 1100–1500m. Fl. July–August.

GENERAL DISTRIBUTION. NE India (Arunachal Pradesh).

ETYMOLOGY. From the Latin *connatus* (fused) in reference to the lateral sepals.

NOTES. This is the first report of the species from Bhutan. It is closely related to *Eria pumila* Lindl. but can be distinguished by its connate lateral sepals forming a tubular mentum and the narrow, obscure lateral lobes of the lip.

22. **E. pumila** Lindl., Gen. Sp. Orchid. Pl.: 68 (1830). Type: Bangladesh, Pandua, coll. *F. De Silva* Wall. Cat. 1972 (holo. K-LINDL!, iso. K-W! K!).

Pinalia pumila (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant epiphytic, 12–15cm tall; *rhizome* stout, covered with fibrous sheaths. *Pseudobulbs* crowded, subcylindric to clavate, compressed, weakly falcate, sheathed, 5–6cm long; sheaths membranous, lanceolate, acute, 1–1.6cm long. *Leaves* 3 or 4, linear-lanceolate, acute, tapered to a short, sheathing petiole, jointed, 6–8 × 0.5–1cm. *Inflorescence* short, globose-capitate, densely many-flowered, 0.4–1cm across; peduncles axillary, pubescent, 2–5mm long; floral bracts oblong, subacute, glabrous, 2–2.5mm long. *Flowers* 2–3mm across, white flushed with pink, lip lateral lobes and column apex red; pedicel and ovary tomentose, c.2mm long. *Sepals* similar, broadly oblong, obtuse, 2–3 × 1–1.5mm. *Petals* narrowly oblong, obtuse, spreading, 2–3mm long. *Lip* 3-lobed, broadly oblong, 2–3mm long; lateral lobes short, dentate, acute, erect; mid-lobe broad, hispid-pubescent, 2-lobed at apex; disc with 2 basal calluses. *Column* pubescent, c.2mm long; foot short. **Plate 18**.

Bhutan: S – Sarbhang district (near Phipsoo); **Sikkim** (Tista River Valley). In subtropical forest on river bank; 300–330m. Fl. March–August.

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. From the Latin pumilus (dwarf).

23. **E. spicata** (D. Don) Handel-Mazzetti, Symb. Sin. 7: 1353 (1936). Types: Nepal, Narainhetty, *Buchanan-Hamilton* s.n. (syn. BM!, isosyn. LINN! Herb. no. 1396.16.1); Nepal, *Wallich* s.n. (syn. BM!).

Octomeria spicata D. Don, Prodr. Fl. Nepal.: 31 (1825).

Pinalia alba Buchanan-Hamilton ex D. Don, Prodr. Fl. Nepal.: 31 (1825), *nom. nud.*

Eria convallarioides Lindl. in Wall. Cat.: 1975 (1829), *nom. nud.*; Gen. Sp. Orchid. Pl.: 70 (1830). Type: Nepal, Thoka, coll. *Wallich* Wall. Cat. 1975 (holo. K-LINDL!, iso. K!).

Octomeria convallarioides Wall. in Lindl., *loc. cit.* (1830), *pro syn.*

Eria convallarioides var. *major* Lindl. in Bot. Reg. 33: t.63 (1847). Type Hort., without provenance.

E. salwinensis Handel-Mazzetti, Symb. Sin. 7: 1352 (1936). Type: China, Yunnan, *Handel-Mazzetti* 9566 (holo. WU).

Plant epiphytic, 23–30cm tall. *Pseudobulbs* tufted, compressed, sheathed when young, 3.5–12 × 0.8–1.8cm; sheaths membranous, overlapping, elliptic-lanceolate, acute, 5–7 × 1.5–2cm.

Leaves 4–6, elliptic-lanceolate, oblong-lanceolate to oblanceolate, acute, subcoriaceous, many-veined, petiolate, 8–28 × 0.6–4.5cm; petiole grooved, 1.5–5cm long. *Inflorescence* axillary, decurved, broadly cylindric, densely many-flowered; peduncle glabrous, 4–8cm long; rachis 3–10cm long; floral bracts ovate-lanceolate, acute, concave, glabrous, 5–7 × 1–1.5mm. *Flowers* subglobose, glabrous, 3–6mm across, white or pale straw-coloured, lip tinged with yellow, column tinged with red; pedicel and ovary puberulent, 2–4mm long. *Sepals* subsimilar, broadly ovate, obtuse, 3–5 × 1.5–3.5mm; *lateral sepals* concave. *Petals* oblanceolate-oblong, spreading, 3–4 × 1.5–3mm. *Lip* obscurely 3-lobed, wedge-shaped, concave, apex subacute, 3mm long; disc lacking lamellae. *Column* slender, 2–4.5mm long; foot incurved. *Fruit* cylindric-ovoid, 5–9 × 5–6mm. **Plate 18.**

Bhutan: S – Phuntsholing district (above Rinchending); C – Punakha district (near Nahi, between Rimchu and Punakha, Tashitang, Tinlegang); N – Upper Mo Chu district (near Tamji); **Darjeeling** (Lebong Cantonment, Kurseong, Rangnu Khola?); **Sikkim** (Neebay?, Penlang La, Rimbi Chhu). In tropical valleys, subtropical jungle slopes, on old tree trunks; 330–2330m. Fl. February–August.

GENERAL DISTRIBUTION. N India, Nepal, Myanmar, China (Yunnan) and Thailand.

ETYMOLOGY. From the Latin *spicatus* (bearing a spike).

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

E. albiflora Rolfe in Bull. Misc. Inform. Kew 1983: 170 (1893). Type: S India, Nilgiri Hills; cult. J. O'Brien (holo. K!).

NOTE. Reported by Bose & Bhattacharjee (1980) from Sikkim. This is a S Indian species; we have seen no specimens from our area, and suspect that the record is based on a misidentification.

E. apertiflora Summerhayes in Bull. Misc. Inform. Kew 1929: 9 (1929). Type: India, Assam, *Hinde* s.n., cult. Kew (holo. K!).

NOTE. Reported by Rao (1996b) from Khellong in the Kameng district of Arunachal Pradesh. We have seen no material from our area.

E. braccata Lindl. in J. Proc. Linn. Soc., Bot 3: 46 (1859). Type: Sri Lanka (Ceylon), *Macrae* 53 (holo. K-LINDL!).

Dendrobium braccatum Lindl., Gen. Sp. Orchid. Pl.: 75 (1830).

Eria reticosa Wight, Icon. Pl. Ind. Orient. 5: 4, t.1637 (1851). Type: India, Pycarrah, *Wight* s.n. (holo. K!).

E. uniflora Dalzell in Hooker's J. Bot. Kew Gard. Misc. 4: 111 (1852). Type: India, *Dalzell* s.n. (holo. K!).

Pinalia braccata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

NOTES. Reported by Bose & Bhattacharjee (1980) from Sikkim as having single flowers up to 8mm long and flowering in April. This species from Sri Lanka and S India has flowers 1.3–2.2cm long which are borne in June. We have found no material to support this report and suspect that it is based on a misidentification.

E. clavicaulis Wall. ex Lindl. in Bot. Reg. 26: misc.90, no.220 (1840). Type: India, unlocalised, *Loddiges* s.n. (holo. K-LINDL!).

Eria khasiana Lindl. in J. Proc. Linn. Soc., Bot. 3: 59 (1859).

Pinalia clavicaulis (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

NOTE. Reported by Das & Deori (1983) from Sikkim, and by Rao & Deori (1980) from the W Kameng district of Arunachal Pradesh. We have been unable to locate any material to confirm these reports.

E. corneri Rchb. f. in Gard. Chron. n.s., 10: 106 (1878). Types: Taiwan (Formosa), *Corner* s.n., cult. Leach (syn. W! Herb. no. 37651); Taiwan (Formosa), icon. Day (syn. K! [icon. in] J. Day, Drawings of Orchids, 22: t.77 (1877)).

NOTE. Reported by Rao (1996b) from Sessa in the Kameng district of Arunachal Pradesh.

E. crassicaulis Hook. f., Fl. Brit. India 5(2): 805 (1890); Icon. Pl. 19: t.1850 (1889). Type: India, Khasia Mountains, Pomrang, *Hooker & Thomson* 9 (holo. K-LINDL!, iso. K!).

Pinalia crassicaulis (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

NOTE. Reported by Bose & Bhattacharjee (1980) from Sikkim. The species is known from Khasia, but we have seen no material from our area. As it is closely related to *E. bambusifolia* it is possible that the report is based on a misidentification.

E. laniceps Rchb. f. in Hamburger Garten-Blumenzeitung 19: 10 (1863). Type: Nepal, *Falconer* 1024 (holo. K!).

Eria flava sensu Griff., Not. Pl. Asiat. 3: 301 (1851), non Lindl.

E. elongata sensu Lindl. in J. Proc. Linn. Soc., Bot. 3: 49 (1859), non Bl. (1856).

Pinalia lobbii Kuntze, Revis. Gen. Pl. 2: 679 (1891). Types: Myanmar (Burma), Moulmein, *Griffith* 346 (syn. K-LINDL!); and *Lobb* s.n. (syn. K-LINDL!).

Eria flava var. *elongata* (Lindl.) Kränzlin in Engler, Pflanzenr. (IV.50) Dendrob.: 55 (1911).

NOTES. Reported by Seidenfaden (1982) from Sikkim based on a Hooker collection in the Lindley herbaium at Kew and a further unnumbered collection in Vienna. There are unnumbered Hooker collections at Kew made in April which we believe to be referrable to *E. lasiopetala*. In the Lindley Herbarium there is a sheet bearing three specimens one identified by Seidenfaden as *E. pubescens*, the other two as *E. laniceps*. We have examined this material and consider it all to be referrable to *E. lasiopetala* and, therefore, consider the Sikkim record doubtful.

E. flava var. *elongata* is based upon material now referred to either *E. lasiopetala* or *E. laniceps*. Kränzlin cited *Pantling* 130 from Sikkim which is clearly referrable to *E. lasiopetala*.

E. muscicola var. oblonga Trimen in J. Ceylon Branch Roy. Asiat. Soc. 9: 88 (1895). Type: Sri Lanka (Ceylon), CP 2355 (holo. K-LINDL!, icon. K!, iso. BM!).

NOTES. Seidenfaden (1982) discussed the taxonomy of this species and its varieties. He pointed out that Rolfe (in annotations on specimens at K) believed the Pantling specimens of *E. muscicola* to consist of two elements and that the ones from Nanchi ("Namtse") were not typical *E. muscicola*. The material is poor and fragile but dissection of the flower reveals a lip without significant basal calluses and strongly deflexed in the middle. It corresponds with the type drawing of var. *oblonga* (CP 2355) at Kew and the drawings in Seidenfaden. This variety has not been reported from our area and we remain very unsure of its true identity. Further material will have to be studied before the taxonomy of this species can finally be resolved.

E. ornata (Bl.) Lindl., Gen. Sp. Orchid. Pl.: 66 (1830). Type: Java, *Kuhl & van Hasselt* s.n. (holo. L! Herb. no. 9023222137).

Dendrobium ornatum Bl., Bijdr.: 345 (1825).

Pinalia ornata (Bl.) Kuntze, Revis. Gen. Pl. 2: 678 (1891).

NOTES. Reported by Bose & Bhattacharjee (1980) from Sikkim. Seidenfaden (1982) discussed the species and felt that reports from NE India were based on misidentifications of the closely related *E. tomentosa* (König) Hook. f. We have seen no material of either species from Sikkim or Bhutan and are unable to confirm this report.

E. pudica Ridley in J. Linn. Soc., Bot. 32: 294 (1896). Type: Singapore, Changi, *Ridley* s.n. (holo. K!).
Eria hindei Summerhayes in Bull. Misc. Inform. Kew 1932: 321 (1932). India, Assam, *Hinde* s.n. cult. (holo. K).

NOTE. Reported by Hegde & Rao (1984) from Sessa in the W Kameng district of Arunachal Pradesh, but we have seen no material from our area.

E. pusilla (Griff.) Lindl. in J. Proc. Linn. Soc., Bot. 3: 48 (1859). Type: India, Khasia, Churra, *Griffith* 666 (holo. K!).
Conchidium pusillum Griff., Not. Pl. Asiat. 3: 321 (1851).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

E. scabrilinguis Lindl. in J. Proc. Linn. Soc., Bot. 3: 51 (1859). Type: India, Sikkim, based on icon. Cathcart s.n. (holo. K!).
Pinalia scabrilinguis (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

NOTES. This name is based on a Cathcart drawing at Kew. The drawing shows a plant with conical, clustered pseudobulbs and 2 ovate-elliptic leaves; inflorescence erect, dense, peduncle short; lip 3-lobed, 2-ridged at base, 5-lamellate in mid-lobe, lamellae fimbriate; sepals and petals pale green, lip pink-maroon. There is no herbarium material. Bose & Bhattacharjee (1980), who stated that the flowers were white, and Das & Deori (1983) both reported it from Sikkim. We consider this species to be highly dubious as did Seidenfaden (1982).

89. **Porpax** Lindl.

Plants clump-forming, epiphytic or lithophytic. *Pseudobulbs* crowded, flattened, covered by one or more sheath(s) which disintegrate into fibres or a fine, reticulate network. *Leaves* 1–3, often appearing after the flowers, oblong-elliptic, margins sometimes ciliolate. *Inflorescence* arising from base or apex of pseudobulb, 1- or 2-flowered; peduncle short; floral bracts conspicuous. *Flowers* orange-red to deep dull red. *Dorsal sepal* connate with lateral sepals to form a sepaline tube. *Petals* narrow. *Lip* minute, obscurely 3-lobed; disc with basal callus. *Column* minute; rostellum broad; pollinia 8.

The genus *Porpax* was described in 1845 by John Lindley in the *Botanical Register*. The genus comprises 11 species distributed in India through Thailand and Indo-China to Malaysia and Borneo.

Seidenfaden (1977b) has monographed the genus and further synonymy can be found there.

TYPE. *Porpax reticulata* Lindl.
ETYMOLOGY. From the Greek *porpax* (handle of shield) in reference either to the shape of the pseudobulbs, or to the pair of oblong leaves which are recurved at their points.

Key to species

1. Inflorescence arising from pseudobulb apex; sheaths around pseudobulb disintegrating into radiating fibres .... **1. P. elwesii**
+ Inflorescence arising from pseudobulb base; surface of pseudobulbs covered by a sheath which disintegrates into a fine net .... **2. P. fibuliformis**

1. P. elwesii (Rchb. f.) Rolfe in Orchid Rev. 16: 8 (1908). Type: Himalayas, *Elwes* s.n., cult. Strickland s.n. (holo. W! Herb. no. 31313, iso. K!).
Eria meirax sensu N.E. Brown in Gard. Chron. n.s. 14: 603 (1880), non (Parish & Rchb. f.) N.E. Brown.
E. elwesii Rchb. f., op. cit. 19: 402 (1883).
Porpax meirax sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta): 114, t.158 (1898), non (Rchb. f.) King & Pantling.

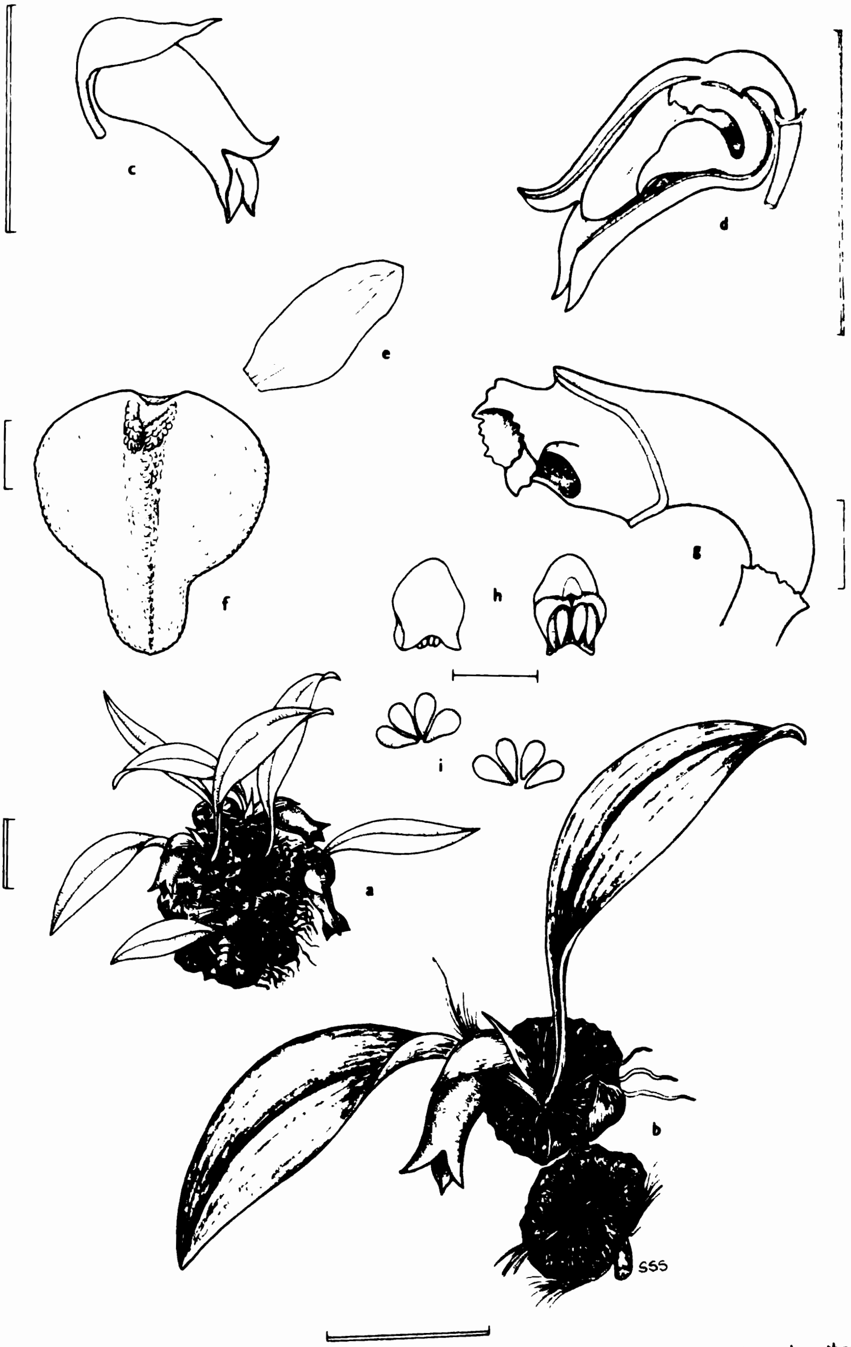


Fig. 90. **Porpax elwesii**: a–b, habit; c, flower; d, section through flower (detail); e, petal; f, lip; g, column; h, anther (two views); i, pollinia. Drawn by Susanna Stuart-Smith, a–b from *White & Sharma* 163 (K); c–i from cult. Kew 871.1930/9765 (K).

Plant epiphytic or lithophytic, 2–2.5cm tall. *Pseudobulbs* globose-turbinate to discoid-lenticular, corm-like, flattened, densely clustered, green with brown veins, covered with a fibrous membrane, 0.5–1cm across. *Leaves* 2, appearing after flowering, elliptic-oblong, mucronate, many-veined, shortly petiolate, 1.7–2.7 × 0.3–0.7cm; petiole 2–4mm long. *Inflorescence* arising from pseudobulb apex, 1-flowered; peduncle short; floral bract large, ovate-lanceolate, erect, concave, acuminate, brown, 5–7 × 3–3.5mm. *Flower* c.1.2cm across, dull purple-brown to red-brown; pedicel and ovary c.2mm long. *Sepals* similar, united into a 3-toothed sepaline tube, 2-lobed and free at apex, 6–8 × 2–3mm; teeth ovate, shortly awned, recurved. *Petals* ovate-elliptic, obtuse, 4–5 × 2–2.5mm. *Lip* obscurely 3-lobed, 3.5–4 × 2.5–3mm; lateral lobes rounded, erect, with a triangular notch at base; mid-lobe oblong to ovate-orbicular, entire, tapering to a blunt apex, 3-veined. *Column* c.1–2mm long; foot long; rostellum large, quadrate. **Fig. 90**.

Darjeeling (Mongpu). 500–830m. Fl. September–October.

GENERAL DISTRIBUTION. Nepal, NE India, Thailand, Vietnam and Malaysia.
ETYMOLOGY. Named after Henry John Elwes (1846–1922), a British arboriculturist and plant collector who collected the type specimen.

2. P. fibuliformis (King & Pantling) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 114, t.157 (1896). Type: India, Darjeeling, Sivok, *Pantling* 278 (holo. CAL, iso. K!).
Eria fibuliformis King & Pantling in J. Asiat. Soc. Bengal 64(3): 336 (1896).

Plant epiphytic, 2–4cm tall. *Pseudobulbs* densely aggregated, depressed-lenticular, 0.7–1.2cm across, covered by a membrane forming a reticulate, cage-like structure. *Leaves* 2, oblanceolate to elliptic, subacute, weakly reticulate, many-veined, sessile, margins minutely ciliolate, 2.4–4.5 × 0.8–1.8cm. *Inflorescence* short, arising from between leaves, 2-flowered; peduncle short, 3–4mm long; floral bracts ovate, c.4mm long. *Flowers* 6–8mm long, uniformly dull red; pedicel and ovary short. *Sepals* united, similar, hispid externally, 7–9mm long; sepaline tube 2-lobed, beaked, gibbous at base. *Petals* oblong-lanceolate, subacute, falcate, c.7mm long. *Lip* 3-lobed, oblong, clawed, attached to base of column foot, c.5mm long; lateral lobes broad, rounded; mid-lobe oblong, lacinate, apex warty; disc with a rounded callus. *Column* c.1.5mm long; foot long; rostellum large; anther cap crested-tuberculate.

Darjeeling (Sivok); **Sikkim** (Gangtok, Orchid Sanctuary (field record); unlocalised *Pantling* specimen). 300–500(–1650)m. Fl. October.

GENERAL DISTRIBUTION. NE India and Laos.
ETYMOLOGY. From the Latin *fibula* (a pin, clasp or brooch) and *forma* (shaped) in reference to the pseudobulbs.

Doubtfully recorded and imperfectly known species.

P. meirax (Parish & Rchb. f.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 114, t.158 (1896). Type: Myanmar (Burma), Moulmein, Tenasserim, *Parish* 251 (holo. W! Herb. no. 31329, iso. K!).
Cryptochilus meirax Parish & Rchb. f. in Trans. Linn. Soc. London 30: 148 (1874).

NOTE. We agree with Seidenfaden (1977b, 1986), who followed Rolfe in considering that plants from Sikkim previously treated as *P. meirax* are referrable to *P. elwesii*, and that *P. meirax* is endemic to the Tenasserim Range.

90. Trichotosia Bl.

Plants epiphytic. *Stems* long or short, leafy except at base, usually covered with reddish-brown or white hispid hairs (hairs sometimes restricted to leaf sheaths and inflorescences). *Inflorescences* lateral, piercing leaf-sheaths, short, few-flowered or long, pendent and many-flowered; floral bracts hairy, large,

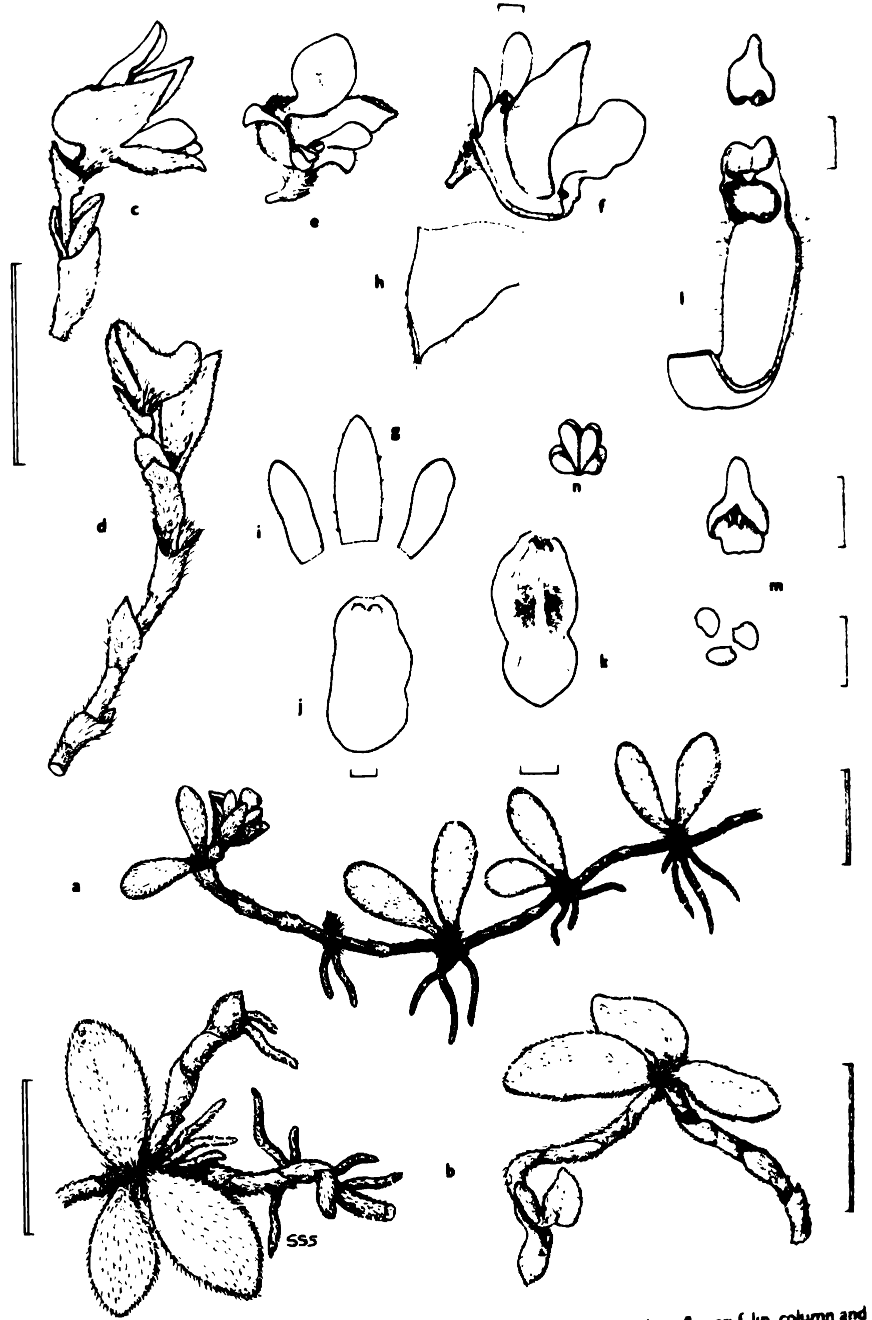


Fig. 91. **Trichotosia dasyphylla**: a–b, habit; c, inflorescence; d, inflorescence (in bud); e, flower; f, lip, column and lateral sepal; g, dorsal sepal; h, lateral sepal; i, petals; j, lip; k, lip (from bud); l, column with detached anther cap; m, anther (with pollinia); n, pollinia. Drawn by Susanna Stuart-Smith, a from icon. in Seidenfaden (1982); b from *Pantling* 90 (K); c–n from *Hooker* 57 (K).

concave, spreading at right-angles to rachis. *Flowers* small to medium in size, not opening widely, resupinate. *Sepals* red-hairy externally; lateral sepals adnate to column foot to form a mentum. *Lip* entire to obscurely 3-lobed; disc with or without keels, sometimes papillose. *Column* with a foot; pollinia 8.

The genus *Trichotosia* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 50 species distributed from mainland Asia, through SE Asia to New Guinea and the south-west Pacific Islands.

Trichotosia has been treated both as a separate genus, and as a section within *Eria*. We here follow the treatment of Seidenfaden (1982), retaining the genus until the *Eria* complex has been re-evaluated.

TYPE. *non designatus*.
ETYMOLOGY. From the Greek *trichosis* (growth of hair) in reference to the general hairiness of these plants.

Key to species

1. Stems creeping, less than 4cm long; inflorescence 1-flowered .... **1. T. dasyphylla**
+ Stems pendent, more than 20cm long; inflorescence 3-to 6-flowered .... **2. T. pulvinata**

1. T. dasyphylla (Parish & Rchb. f.) Kränzlin in Engler, Pflanzenr. (IV.50) Dendrob.: 138 (1911).
Type: Myanmar (Burma), Mergui, *Parish* 79 (holo. W! Herb. no. 31028, iso. K!).
Eria dasyphylla Parish & Rchb. f. in Trans. Linn. Soc. London 30: 147 (1874).
Pinalia dasyphylla (Parish & Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).

Plant 1–2cm tall. *Stems* creeping, branched, pale-hairy in new growth, brown-hispid in old growth, 3–6cm long. *Leaves* elliptic-ovate to obovate, obtuse, fleshy, sessile, covered with long, hispid hairs and short, whitish wool, 1.2–2 × 0.4–0.8cm. *Inflorescence* 1-flowered; peduncle short, pubescent; floral bract lanceolate, 4–5mm long. *Flowers* 1–1.2cm long, green, flushed with yellow, lip base with a brownish-purple patch; pedicel and ovary hispid, 5–6mm long. *Sepals* subsimilar, pubescent externally; *dorsal sepal* small, elliptic, 3-veined, erect, 2–3mm long; *lateral sepals* large, broadly triangular, concave, 3.5–5 × 1.5–2mm; *mentum* broadly rounded, c.1.5mm long. *Petals* oblong, obtuse, c.3 × 1.3mm. *Lip* large, obscurely 3-lobed, wedge-shaped to oblong, ciliolate, base narrowed, 3.5–4 × 2mm; lateral lobes very shallow; mid-lobe deflexed, apex broad, emarginate, margins minutely erose. *Column* c.2mm long; foot long, curved. *Fruit* ovoid, c.6 × 3mm. **Fig. 91.**

Darjeeling (Pankhabari); **Sikkim** (unlocalised Kurz and *Pantling* specimens). In tropical valleys; 330–660m. Fl. April–June.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China (Yunnan), Thailand, Laos and Vietnam.
ETYMOLOGY. From the Greek *dasy-* (hairy, shaggy) and *phyllon* (leaf).

2. T. pulvinata (Lindl.) Kränzlin in Engler, Pflanzenr. (IV.50) Dendrob.: 138 (1911). Type: Myanmar (Burma), Mergui, icon. Griffith 2 (holo. K-LINDL!).
Eria pulvinata Lindl. in J. Proc. Linn. Soc., Bot. 3: 56 (1859).
E. rufinula Rchb. f. in Hamburger Garten-Blumenzeitung 19: 13 (1863). Type: India, Assam, *Schiller*, cult. Day (holo. W! Herb. no. 20056).
Pinalia pulvinata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679 (1891).
P. rufinula (Rchb. f.) Kuntze, loc. cit. (1891).
Trichotosia rufinula (Rchb. f.) Kränzlin, op. cit. 143 (1911).

Plant 13–35cm tall; *roots* arising from stem. *Stems* pendent, cylindric, hispid, 25–30 × 0.3–0.45cm; *internodes* 2–3cm long. *Leaves* many, narrowly lanceolate, acute to acuminate, sessile, reddish-pubescent, jointed, 6–10 × 1–1.2cm. *Inflorescence* arising opposite leaves, short, 3- to 6-flowered;

peduncle sheathed at base; sheath ovate, c.4mm long; rachis hispid, 1–1.5cm long; floral bracts cordate, concave, hispid, c.8 × 4mm. *Flowers* 0.7–1cm long, white flushed with pink, anther cap flushed purple; pedicel and ovary hispid, c.3mm long. *Sepals* subequal, ovate-lanceolate, subacute, hispid externally, 0.7–1 × 0.3–0.4cm; *lateral sepals* weakly falcate, forming a mentum with the column foot; *mentum* c.2mm long. *Petals* narrowly lanceolate, obtuse, spreading, 7 × 2.5mm. *Lip* simple, spathulate, margins reflexed, 6–9 × c.4mm (at apex); disc with an elongate pulvinate callus towards apex. *Column* 5–6mm long; foot sigmoidally curved. *Fruit* ovoid, c.1.1 × 0.5cm.

Darjeeling (Kurseong); **Sikkim** (unlocalised *Gamble* and *Pantling* specimens). In tropical valleys. Fl. March–May; Fr. May.

GENERAL DISTRIBUTION. NE India, Myanmar, China, SE Asia to Malaysia.
ETYMOLOGY. From the Latin *pulvinatus* (cushion-shaped) in reference to the lip callus.
NOTE. This species was more commonly known in the Himalayas under the name of *T. rufinula*.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

T. velutina (Loddiges ex Lindl.) Kränzlin in Engler & Prantl, Nat. Pflanzenfam. (IV.50) Dendrob.: 140 (1911). Type: Singapore, *Cuming* s.n. (holo. K!).
Eria velutina Loddiges ex Lindl. in Bot. Reg. 26: misc.86, no.209 (1840).

NOTE. Reported by Hegde & Rao (1987) from Tipi in the W Kameng district of Arunachal Pradesh.

Subtribe **Podochilinae** Bentham & Hook. f.

91. **Appendicula** Bl.

Plants epiphytic or lithophytic. *Stems* erect or pendent, simple or branched, lacking pseudobulbs. *Leaves* distichous, flat, twisted at base so that the blades lie in one plane. *Inflorescence* terminal, lateral, or both, racemose. *Flowers* small, resupinate. *Lateral sepals* connate at base to column foot to form a mentum. *Lip* with a round or concave basal appendage, sometimes keeled; mid-lobe often with a median keel or callus. *Column* with a foot; pollinia 6 on a solitary, forked caudicle, or on 2 separate ones.

The genus *Appendicula* was established by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 60 species distributed from tropical Asia to the south-west Pacific Islands.

Schlechter (1900) monographed *Appendicula* but included it at sectional level under *Podochilus* Bl; he later reinstated it as a genus.

TYPE. *non designatus*.
ETYMOLOGY. From the Latin *appendicula* (little appendix) in reference to the lip callus.

1. **A. cornuta** Bl., Bijdr. 1: 302 (1825). Type: Java, Seribu and Pantjar, *Blume* s.n. (holo. L! *sine loc.*, Herb. no. 902322237).
Dendrobium bifarium Lindl., Gen. Sp. Orchid. Pl.: 81 (1830). Type: Malaysia, Penang, coll. *Porter* Wall. Cat. 2002 *p.p.* (holo. K!).
Appendicula bifaria (Wall. ex Lindl.) Lindl. in Hooker's J. Bot. Kew Gard. Misc. 7: 35 (1855). Type: Hong Kong, Mount Gough, *Champion* 282 (holo. K-LINDL!).
A. bifaria var. *wallichiana* Hook. f., Fl. Brit. India 6(1): 83 (1890). Type from Malaysia.
Podochilus cornutus (Bl.) Schltr. in Mém. Herb. Boissier 8(21): 34 (1900).

Plant 17–50cm tall. *Stems* tufted, slender, covered by leaves, 17–50cm long; internodes 0.8–1cm long. *Leaves* many, oblong-lanceolate, subacute, emarginate to truncate-mucronate, many-veined, the

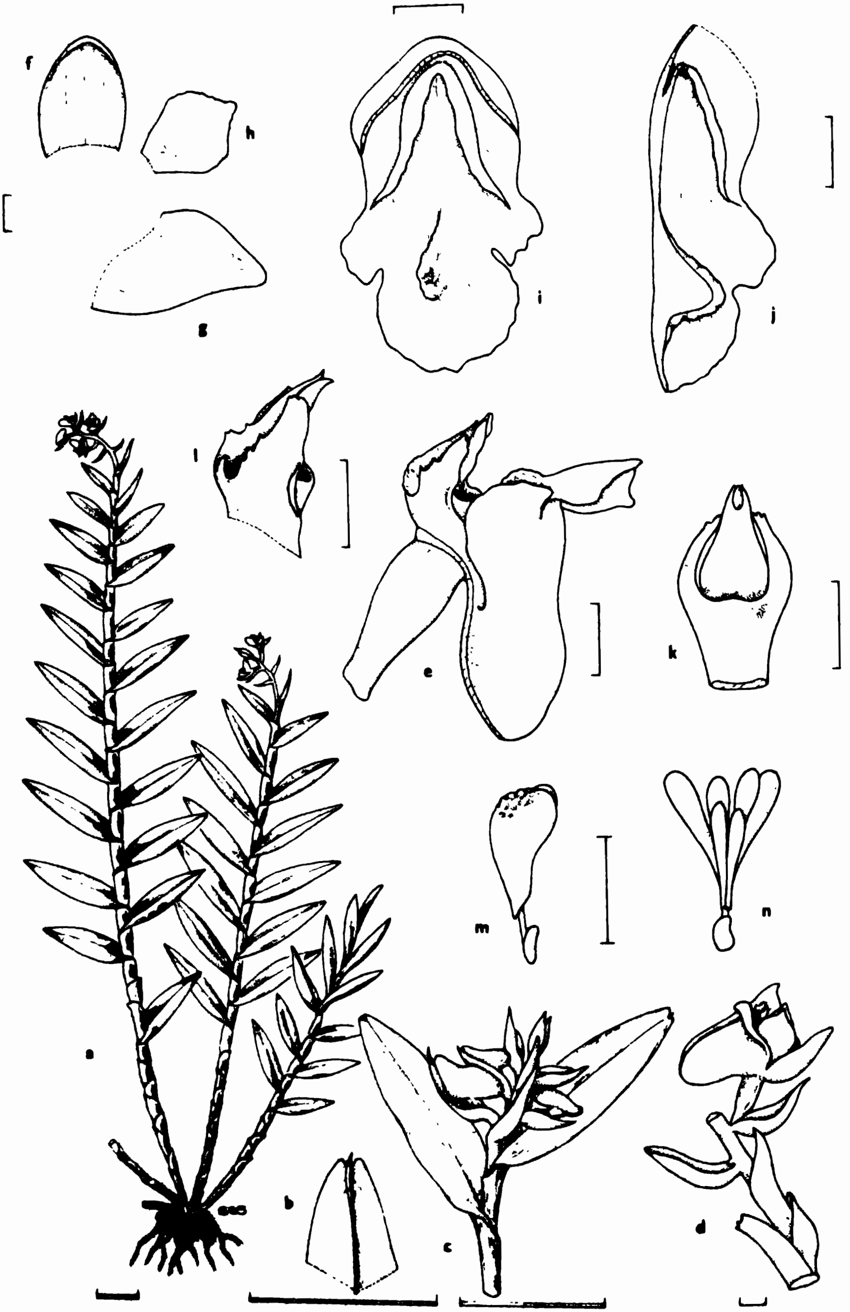


Fig. 92. *Appendicula cornuta*: a, habit; b, leaf apex; c, inflorescence; d, inflorescence (detail); e, lip, column and ovary; f, dorsal sepal; g, lateral sepal; h, petal; i, lip; j, lip (from side); k, column; l, column (side view); m, pollinarium (with anther cap); n, pollinarium Drawn by Susanna Stuart-Smith, a–c from *Pantling* 288 (K); d–n from *Parish* 365 (K)

central one prominent, sheathing at base, 2–3.5 × 0.6–1cm. *Inflorescences* terminal and lateral, laxly 6-to 8-flowered or subdensely many-flowered; peduncle 7–9mm long; rachis 5–7mm long; floral bracts narrowly lanceolate, acuminate, reflexed, 4–5 × 0.5–1mm. *Flowers* 4–7.5mm long, white, yellowing with age; pedicel and ovary hispid, c.2mm long. *Sepals* subsimilar, oblong, obtuse, glabrous or hispid externally, 3–4 × 1–3mm; *dorsal sepal* concave; *lateral sepals* partly joined, apices spreading; *mentum* 2–3mm long. *Petals* obovate-oblong. *Lip* ovate, deflexed, fleshy, obtuse, with a concave, horseshoe-shaped basal appendage, 2.3mm long; callus broad, cylindric. *Column* with long-pointed stelidia on either side of the rostellum, 1–1.5mm long; rostellum long. *Fruit* ovoid, ridged, 6–7 × 3–4mm. **Fig. 92.**

Sikkim (unlocalised Pantling specimens). In tropical valleys. Fl. August.

GENERAL DISTRIBUTION. NE India, Myanmar, China (Hainan), Thailand, Cambodia, Vietnam, E Indonesia, E Malaysia and the Philippines.

ETYMOLOGY. From the Latin *cornutus* (horn-shaped), a reference to the mentum.

NOTES. The Sikkim plants were formerly known by the name *A. bifaria* Lindl. Seidenfaden (1986) commented upon the considerable variability of this species and gave a more complete synonymy.

92. Podochilus Bl.

Plants small, epiphytic or lithophytic, forming dense mats. *Stems* slender, tufted, leafy, erect to spreading. *Leaves* short, distichous, lying in one plane. *Inflorescence* terminal, racemose, few- to many-flowered. *Flowers* minute or small, resupinate. *Sepals* and *petals* similar, adnate at base or free; lateral sepals adnate to the column foot forming an often spur-like mentum; petals smaller than the sepals. *Lip* narrow, entire to obscurely 3-lobed; disc with a simple or 2-lobed appendage. *Column* short; foot long, curved; pollinia 4.

The genus *Podochilus* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. There are about 60 species distributed from India, Sri Lanka and China south to Indonesia, New Guinea and the south-west Pacific Islands.

Schlechter (1900) proposed a treatment of *Podochilus* which incorporated *Appendicula* as a section; he later revised this, reinstating *Appendicula* as a genus.

TYPE. *Podochilus lucescens* Bl.

ETYMOLOGY. From the Greek *podos* (a foot) and *cheilos* (a lip) in reference to the 2 introrse appendices on the lip base.

Key to species

1.	Leaves equitant, overlapping at base, not jointed	**1. P. cultratus**
+	Leaves not equitant, distantly inserted along stem, jointed	**2. P. khasianus**

1. P. cultratus Lindl., Gen. Sp. Orchid. Pl.: 234 (1833). Type: Nepal, Hetaunda (Hataura), coll. *Wallich* Wall. Cat. 7336 (holo. K-LINDL!, iso. K-W! K!).

Plant epiphytic, 7–13cm tall. *Stems* glabrous, completely covered by leaves, 4–13cm long. *Leaves* many, equitant, lanceolate, falcate, acute, many-veined, 0.9–1.2 × 0.4–0.8cm (when spread). *Inflorescence* slender, often rooting from nodes, 2- to 4-flowered; rachis 1.2cm long; floral bracts broadly ovate-lanceolate, acute to acuminate, cuspidate, 2.5–3 × 0.8–1.1mm. *Flowers* c.5mm across, white flushed with pink; pedicel and ovary sessile, glabrous,1–1.5mm long. *Sepals* ovate, acute to subacute, 2–4.5 × 1–1.5mm. *Petals* rhombic to obovate, obtuse to subacute, 1.5–3.5mm long. *Lip* simple, oblong, 2-lobulate at apex, lobules rounded, deflexed, attached to base of the column foot, 1.5–3mm long; disc smooth. *Column* very short; rostellum prominent; anther cap long-beaked, c.0.5mm long. *Fruit* ovoid, subsessile, 6–7 × 3–4mm. **Plate 19.**

Bhutan: S – Sarbhang district (Singi Khola,10km SW of Sarbhang); **Sikkim** (unlocalised Hooker and Pantling specimens). On trees in subtropical terai forest on river bank; 390m. Fl. March–June.

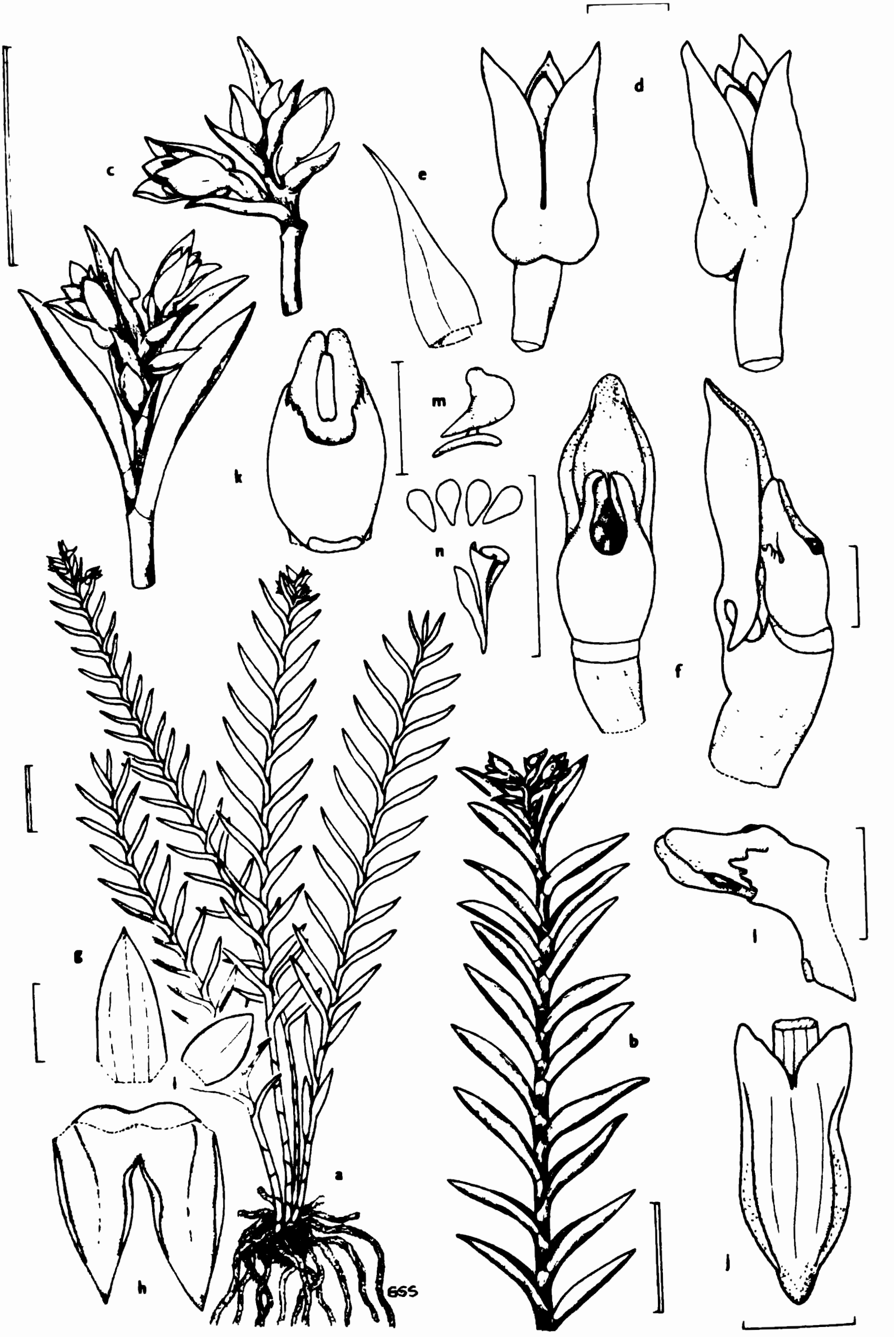


Fig. 93. ***Podochilus khasianus***: a, habit; b, habit (partial); c, inflorescence (two views); d, flower (two views); e, floral bract; f, lip and column (two views); g, dorsal sepal; h, lateral sepals; i, petal; j, lip; k, column; l, column (side view), m, pollinarium with anther cap; n, pollinarium (details). Drawn by Susanna Stuart-Smith, a from *Pantling* 187 (K); b–n from *Grierson & Long* 4109 (E).

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China and Thailand.
ETYMOLOGY. From the Latin *cultratus* (shaped like a knife-blade) in reference to the leaf shape.

2. **P. khasianus** Hook. f., Fl. Brit. India 6(1): 81 (1890); Icon. Pl. 22: t.2146 (1894). Types: Bangladesh, Sylhet, coll. F. *De Silva* Wall. Cat. 7335B (syn. K-LINDL!, isosyn. K-W! K!); India, Khasia Hills, Amwee *Hooker & Thomson* s.n. (syn. K!).
Podochilus chinensis Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 19: 380 (1924). Type: China, Guangdong (Kwangtung), K.K. *Tsoong* 3808 (holo. B).

Plant epiphytic or lithophytic, 8–12cm tall; *roots* fasciculate. *Stems* slender, tufted, suberect, covered by sheathing leaf bases, 8–15cm long. *Leaves* many, linear to linear-oblong, acute, coriaceous, jointed, sometimes twisted, sheathing at base, 0.9–1.4 × 0.1–0.2cm. *Inflorescence* 3- or 4-flowered; rachis glabrous, weakly zigzag, 5–6mm long; floral bracts persistent, broadly ovate-lanceolate, acute to acuminate, 3-veined, 2–4.1 × 0.8–1.1mm. *Flowers* 3–4mm long, white flushed with yellow or pink; pedicel and ovary c.1.5mm long. *Sepals* similar, oblong-ovate, 1.5–2.6 × 0.6–1.2mm; *lateral sepals* connate at base to form a short mentum; *mentum* globose, c.1 × 1mm. *Petals* oblong-ovate, obtuse, 1.5–2 × 0.8–1mm. *Lip* simple, clawed, oblong-lanceolate, broadly sagittate-cordate at base, apiculate, margins inrolled, fleshy, minutely ciliolate, 1–2.4 × 0.8–0.9mm; disc ecallose. *Column* stout, 2 triangular-auriculate, stelidia basal, apex deeply 2-lobulate, 0.8–1.1mm long; rostellum broad, obtuse; anther cap short, 2-cuspidate, c.0.4mm. *Fruit* ovoid-ellipsoid, c.3 × 2mm. **Fig. 93.**

Bhutan: S – Gaylegphug district (below Sham Khara). **Sikkim** (unlocalised *Pantling* specimen). On cliff face, in rocky gorge of stream; 1150m. Fl. March–May.

GENERAL DISTRIBUTION. NE India, Bangladesh and China.
ETYMOLOGY. From the Khasia Hills where the type specimen was collected.
NOTES. Schlechter (1900) reduced *P. khasianus* into the synonymy of *P. microphyllus* Lindl. and Seidenfaden (1986) reviewed the confusion between these species. Although they are very similar *P. khasianus* can be distinguishd by its cordate-sagittate lip base and the 2-cuspidate anther cap.

Subtribe **Thelasiinae** Schltr.

93. **Phreatia** Lindl.

Plants epiphytic. *Stems* pseudobulbous or caulescent. *Leaves* 1–3 (pseudobulbous species) or c.12 (caulescent species), distichous to flabellate, erect to spreading, sometimes fleshy, jointed on equitant sheaths. *Inflorescences* lateral, axillary (from base of pseudobulb), racemose, densely many-flowered. *Flowers* minute, resupinate; pale green or white, often cleistogamous. *Sepals* and *petals* similar, spreading; lateral sepals adnate to column foot to form a mentum. *Lip* entire or obscurely 3-lobed, concave. *Column* short, with a distinct foot; pollinia 8; stipe long; viscidium ovate.

The genus *Phreatia* was established in 1830 by John Lindley in his *Genera and Species of Orchidaceous Plants*. The genus comprises about 150 species distributed from mainland Asia, through SE Asia to Australia, New Guinea and the Pacific Islands.

Kränzlin (1911b) proposed a sectional treatment for *Phreatia* which Schlechter (1913) revised.

TYPE. *Phreatia elegans* Lindl.
ETYMOLOGY. From the Greek *phreatia* (a well) in reference to the structure formed by the lateral sepals and lip.

1. **P. elegans** Lindl., Gen. Sp. Orchid. Pl.: 63 (1830). Type: Sri Lanka (Ceylon), Peradeniya, *Macrae* 38 (holo. K-LINDL!, iso. BM!).
Thelasis elegans (Lindl.) Bl., Mus. Bot. 2: 187 (1856).

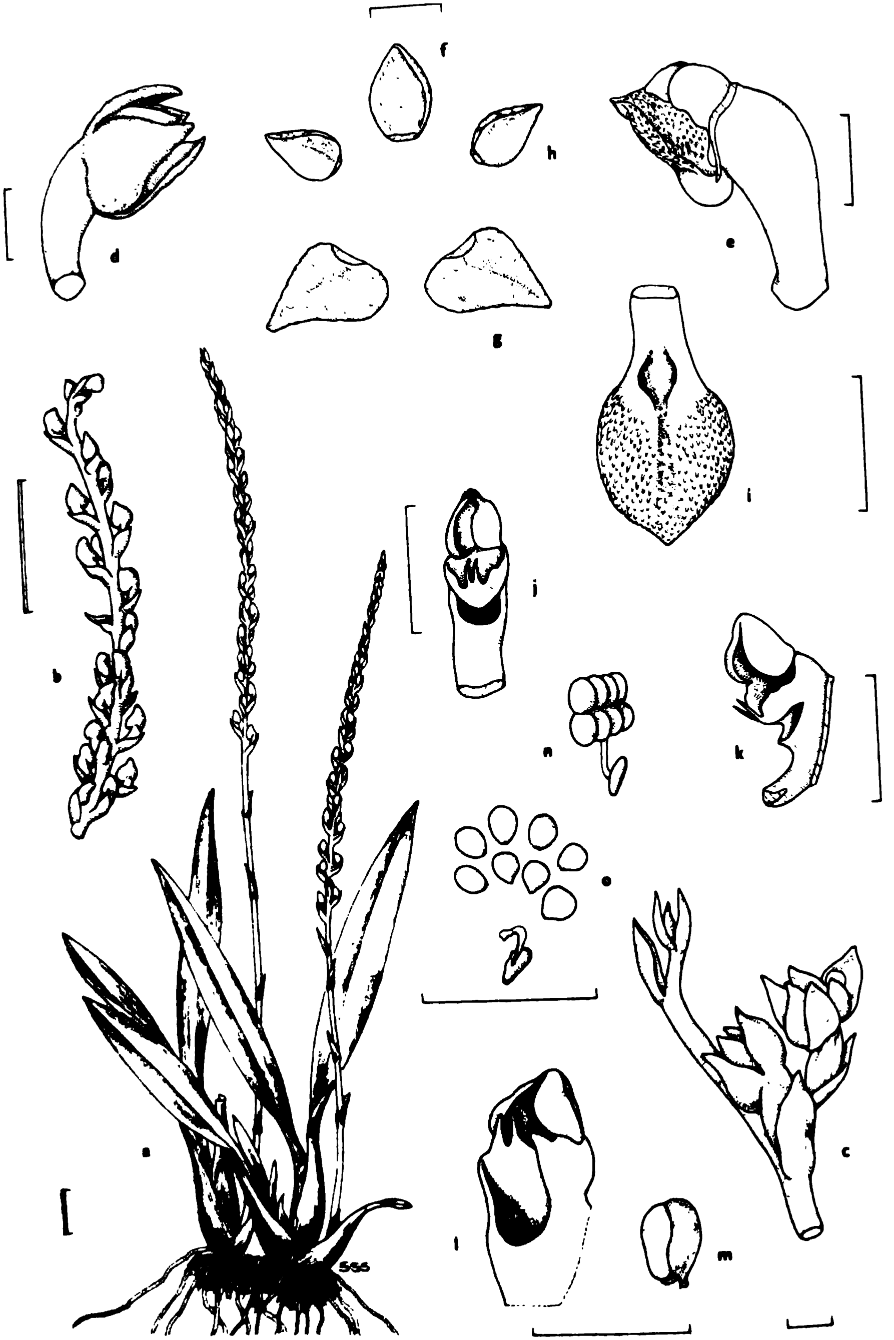


Fig. 94. **Pinalia elegans**: a, habit; b, inflorescence; c, inflorescence (detail); d, flower; e, lip, column and ovary; f, dorsal sepal; g, lateral sepals; h, petals; i, lip; j, column; k, column (side view); l, column (side view); m, anther cap; n, pollinarium; o, pollinarium (details). Drawn by Susanna Stuart-Smith, a–b and d–i from *Macrae* s.n. (K); b and j–n from *Chand* 6061 (K); o from icon. in King & Pantling (1898).

Plant 13–19cm tall; root fibres fascicled, stout. *Stems* ± pseudobulbous, densely tufted, 0.5–1 × 0.5–0.9cm. *Leaves* 1–3, linear-oblong to oblanceolate, obtuse to retuse, distichous, narrowed to sessile base, 1-veined, 5–12 × 0.5–0.8cm. *Inflorescence* lateral (from pseudobulb base), densely many-flowered; peduncle erect, glabrous, sheathed, 6–10cm long; sheaths lanceolate, subacute, distant, 5–7 × 1–1.5mm; rachis glabrous, 4–7cm long; floral bracts ovate-oblong to obovate-oblong, acuminate, 1-veined, sheathing the ovary, 2–2.5 × 0.6–1.1mm. *Flowers* c.2mm across, white; pedicel and ovary curved, c.2mm long. *Dorsal sepal* broadly ovate, acute to acuminate, 1-veined, 1.2–2 × 0.6–1mm; *lateral sepals* broadly triangular, acute, 1-veined, gibbous-saccate at base, adnate to the column foot, 1.2–2.5 × 0.4–0.6mm; *mentum* rounded. *Petals* broadly ovate-elliptic, acute, 0.5–0.9 × 0.4–0.6mm. *Lip* very small, simple, clawed, orbicular to triangular, obscurely 3-veined, pilose within, margins weakly undulate, c.1mm long. *Column* truncate, 2-horned at apex, 0.5–0.6mm long; foot 0.1–0.13mm long; stipe long. Fig. 94.

Darjeeling (Labha); **Sikkim** (Chunthang, Naru Valley?). 2000m. Fl. August–September.

GENERAL DISTRIBUTION. Sri Lanka and NE India.
ETYMOLOGY. From the Latin *elegans* (elegant).
NOTE. Seidenfaden (1986) referred *P. elegans* to section *Phreatia* (Schlechter's section *Bulbophreatia*) because of the few-leaved pseudobulbs.

94. Thelasis Bl.

Plants epiphytic. *Stems* either pseudobulbous, 1- or 2-leaved, with sheaths and sometimes additional smaller leaves at base, or short and unthickened with several leaves in 2 opposite ranks, laterally compressed and overlapping at base. *Leaves* narrow, thin. *Inflorescence* lateral, racemose, many-flowered. *Flowers* small, resupinate. *Sepals* and *petals* similar, spreading at apex only. *Column* short, lacking a foot; pollinia 8 (in 2 groups of 4).

The genus *Thelasis* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 20 species distributed from India eastwards to New Guinea and the Pacific Islands.

Hooker (1890) proposed a sectional treatment for the genus; all the species in our region belong to section *Thelasis*.

LECTOTYPE. *Thelasis obtusa* Bl.
ETYMOLOGY. From the Greek *thele-* (a nipple) probably a reference to the attenuate rostellum.

Key to species

1. Lateral sepals not keeled or winged; leaf more than 7cm long ………………… **1. T. longifolia**
+ Lateral sepals distinctly keeled or winged; leaf less than 7cm long …………… **2. T. pygmaea**

1. T. longifolia Hook. f., Fl. Brit. India 6(1): 87 (1890); Icon. Pl. 22: t.2155 (1894). Type: India, Khasia Mountains, *Hooker & Thomson* 29B (holo. K-LINDL!, iso. K!).

Plant 17–22cm tall; roots fasciculate. *Pseudobulbs* conical, 1.5–1.7 × 1.2–2.1cm wide. *Leaf* 1, arising from pseudobulb apex, narrowly oblong to oblanceolate, tapering to sessile base, 7–19 × 1.2–2.8cm. *Inflorescence* arising from newly developing pseudobulb, subdensely many-flowered; peduncle glabrous, sheathed, 14–18cm tall; sheaths lanceolate, subacute, membranous, 4.5–5 × 1–1.5mm; rachis glabrous, 2.5–4.5cm long; floral bracts short, broadly ovate-triangular, acute to acuminate, 2–2.5 × 1–1.5mm. *Flowers* c.5mm across, uniformly green; pedicel and ovary 0.5–1mm long. *Sepals* subsimilar, 3–3.5 × 0.8–1mm; *dorsal sepal* ovate-elliptic; *lateral sepals* ovate, obtuse. *Petals* narrowly ovate, acute, 2.5–3mm long. *Lip* simple, 2–3 × 1–1.5mm, elliptic-ovate, entire, tapering to a mintely emarginate apex, ecallose. *Column* tapering to apex, c.1mm long; rostellum long, narrow, acuminate; anther cap long-beaked. *Fruit* ovoid to obovoid, 4–6 × 1.5–2.5mm.

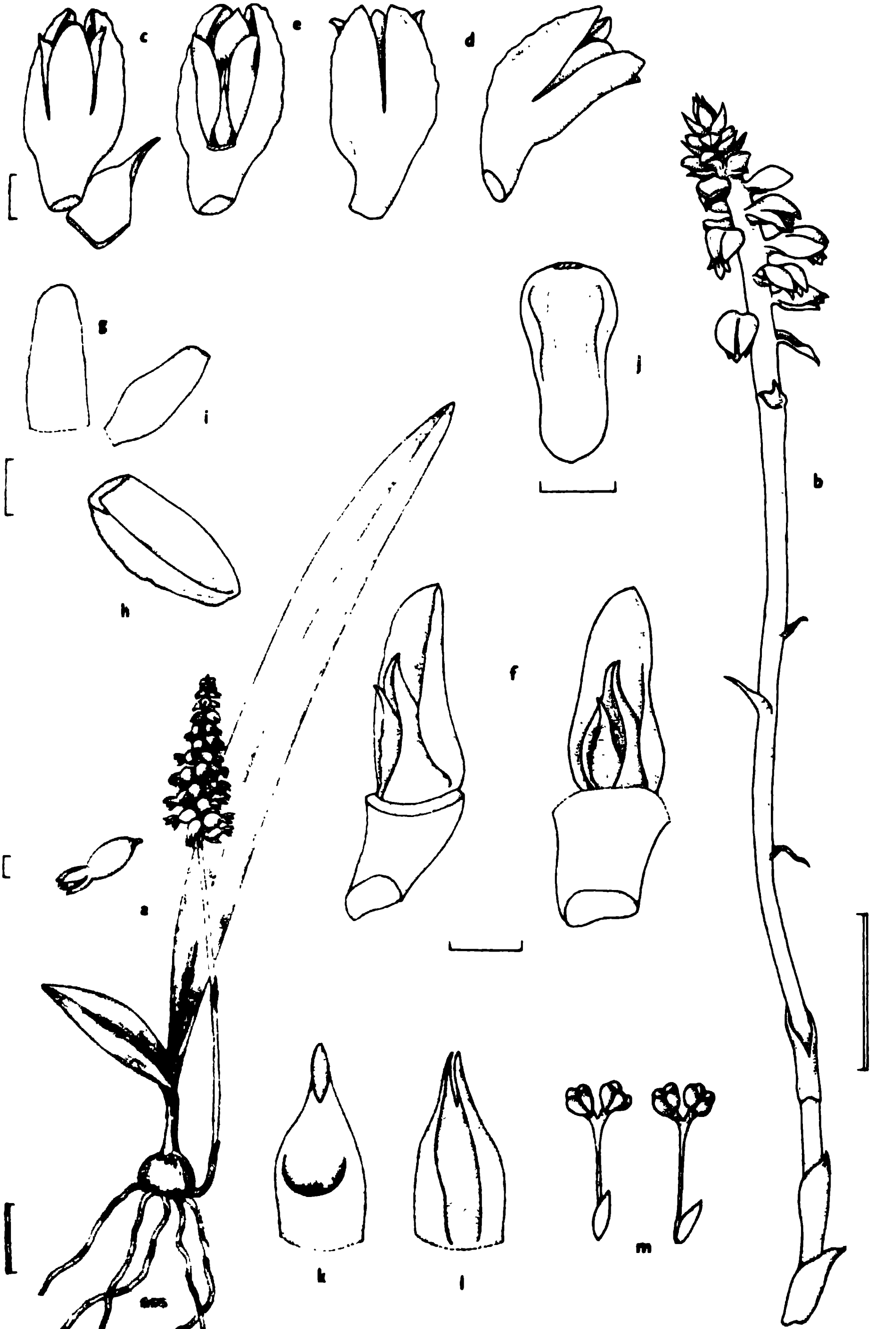


Fig. 95. **Thelasis pygmaea**: a, habit (with an enlarged fruit); b, stem and inflorescence; c, flower with bract; d, flowers (two views); e, flower (with dorsal sepal removed); f, lip and column (two views); g, dorsal sepal; h, lateral sepal; i, petal; j, lip; k, column (front view); l, column (back view); m, pollinarium (two views). Drawn by Susanna Stuart-Smith, a from *Pantling* 235 (K); b–m from *Hermans* 931 (K).

Darjeeling (unlocalised Cowan specimen); **Sikkim** (unlocalised Pantling specimen). In tropical valleys. Fl. April–July.

GENERAL DISTRIBUTION. India.
ETYMOLOGY. From the Latin *longus* (long) and *folius* (leaf).

2. T. pygmaea (Griff.) Bl., Fl. Javae nov. ser.: 22 (1858). Type: Nepal, *Lawrence* s.n., cult. (holo. CAL).
Euproboscis pygmaea Griff. in Calcutta J. Nat. Hist. 5: 372, t.26 (1844).
Thelasis elongata Bl., Mus. Bot. 2: 187 (1856). Type from Java.
T. pygmaea var. *multiflora* Hook. f., Fl. Brit. India. 6(1): 86 (1890). Type: India, Sikkim, *Treutler* 631 (holo. K!), **syn. nov.**
T. hongkongensis Rolfe in Bull. Misc. Inform. Kew 1896: 199 (1896). Types: China, Hong Kong, *Hance* 1287 (syn. K-LINDL!); *Ford* 18 (syn. K!).
T. clausa Fukuyama in Bot. Mag. (Tokyo) 49: 440 (1935). Type from Japan.

Plant clustered, 8–12cm tall; *roots* fasciculate. *Pseudobulbs* ovoid-globose, rugose when dry, 0.6–1 × 0.6–1.5cm. *Leaves* 1 or 2, linear-oblong, sessile, fleshy, 2.5–7.5 × 0.5–1cm. *Inflorescence* lateral, arising from base of pseudobulb, densely many-flowered; peduncle sheathed, 4–6cm tall; sheaths ovate, acute, 3–4 × 1–2mm; rachis 1–2cm long; floral bracts ovate, acuminate, scarious, persistent, 1.5–2 × 0.5–1mm. *Flowers* not opening fully, 2–3mm long, uniformly pale green; pedicel and ovary 1–1.5mm long. *Dorsal sepal* ovate-lanceolate, acute, 2.5–3 × 0.8–1.1mm; *lateral sepals* linear-oblong, concave, 1-veined, keeled; connate at base, 2.5–3mm long. *Petals* oblong, obtuse, apices recurved, 2–2.5 × 0.8–1mm. *Lip* obscurely 3-lobed, 2.5–3 × 1.4–1.6mm; lateral lobes erect, rounded; mid-lobe oblong, obtuse, 3-veined; ecallose. *Column* tapering upwards to an acute apex, c.2.5 × 0.8mm; rostellum long, minutely bifid; anther dorsal; anther cap long-beaked, c.1.8mm long. *Fruit* ovoid, 2–3 × 1–1.5mm. **Fig. 95.**

Darjeeling (unlocalised *Griffith* specimen); **Sikkim** (unlocalised *Pantling* and *Treutler* specimens). In tropical valleys. Fl. August–September.

GENERAL DISTRIBUTION. Nepal, India, Myanmar, China, Thailand, Vietnam, Japan, Malaysia, Sumatra, Java, Borneo, the Philippines to the Solomon Islands.
ETYMOLOGY. From the Latin *pygmaeus* (dwarf).
NOTES. Seidenfaden (1986) discussed the taxonomy of this species and we follow his treatment here. Hooker (1890) described a var. *multiflora* which we have examined; although the material is poor, we consider it to be typical *T. pygmaea* and reduce it to synonymy.

Doubtfully recorded and imperfectly known species.

T. bifolia Hook. f., Fl. Brit. India 6(1): 86 (1890); Icon. Pl. 22: t.2153 (1894). Type: India, Khasia Mountains, *Lobb* s.n. (holo. K!).

NOTE. Reported by Das & Deori (1983) from Sikkim, but we have seen no material to support this record.

T. khasiana Hook. f., Fl. Brit. India 6(1): 87 (1890); Icon. Pl. 22: t.2154 (1894). Types: India, Khasia Mountains, *Lobb* (syn. K not found); *Hooker & Thomson* 29A (syn. K-LINDL!, isosyn. K!).
Thelasis pygmaea var. *khasiana* (Hook. f.) Schltr. in Mém. Herb. Boissier 8(21): 71 (1900).

NOTES. Seidenfaden (1986) received living material from Sikkim from Udai Pradhan of what he believed to be *T. khasiana*. We have seen no material of this species and since the plant is closely related to *T. longifolia*, further collections are required before this report can be confirmed.

Tribe **Dendrobieae** Endlicher

Subtribe **Dendrobiinae** Lindl.

95. **Dendrobium** Sw.

Plants epiphytic, lithophytic or rarely terrestrial. *Stems* either (a) rhizomatous, (b) erect and many-noded, (c) erect and 1- or several-noded from a many-noded rhizome, or (d) lacking a rhizome, the new stems many-noded, arising from base of the old ones; tough and fleshy, swollen at base or along whole length, often pseudobulbous and ± covered with sheathing leaf bases and bladeless sheaths. *Leaves* 1 to many, apical from pseudobulb or arranged distichously along stem, linear-lanceolate, oblong or ovate, papery or coriaceous, apex usually 2-lobed or emarginate. *Inflorescence* racemose, 1- to many-flowered, erect, horizontal or pendent, lateral or terminal. *Flowers* often showy, resupinate or non-resupinate, ephemeral or long-lived. *Sepals* short to filiform; *lateral sepals* adnate to the elongate column foot to form a more or less prominent mentum; *mentum* often spur-like. *Petals* similar to sepals. Lip entire to 3-lobed, base joined to the column foot, often forming a closed spur with the lateral sepals; disc 1- to 7-keeled, usually ecallose. *Column* short with apical stelidia; foot long; pollinia 4 in appressed pairs, naked.

The genus *Dendrobium* was established in 1799 by O. Swartz in *Nova Acta Regiae Societatis Scientiarum Upsaliensis.* Holttum, Brieger & Cribb (1979) proposed the adoption of *D. moniliforme* (L.) Sw. as the type for the genus and this proposal was accepted. The genus comprises c.1400 species distributed from India across to Japan, south to Malaysia, Indonesia and east to New Guinea, Australia, New Zealand and the Pacific Islands.

Kränzlin (1911a) and Schlechter (1912) proposed sectional treatments for *Dendrobium*. Brieger (1981) raised several sections to generic rank and some of these have recently been taken up by other authors – see Rauschert (1983), Clements & Jones (1997a, b) and Lavarack *et al.* (2000). We prefer to accept *Dendrobium* in a broad sense until a detailed analysis of the whole genus has been published. Seidenfaden (1985) revised the Thai species and a fuller synonymy of the widespread species can be found there.

A variety of insect pollinators has been reported for *Dendrobium* species from different areas and includes various bees (Jones, 1974; Adams & Lawson, 1987, 1988), syrphid flies (Gilbert, 1985), ichneumon and thynnid wasps (Jones, 1974) and the weevil *Cyttalia sydneyensis* (Lister, 1987). Kjellson & Rasmussen (1987) suggested that *D. unicum* Seidenfaden attracted pollinators by mealy pseudo-pollen that is contained on a longitudinal callus, but Kjellson *et al.* (1985) reported that *D. infundibulum* Rchb. f. acted as a floral mimic and offered no reward to visiting bumble-bees which also pollinated *Rhododendron lyi* which grew nearby.

Dressler (1989) explained how movement of the beaked anther cap by the visiting pollinator ruptured the rostellar membrane, releasing glue onto the insect, to which the ejected pollinia could stick. The membrane over the rostellar glue may be the reason why *Dendrobium* has not evolved a viscidium (Dressler, 1993).

TYPE. *Dendrobium moniliforme* (L.) Sw.; basionym: *Epidendrum moniliforme* L., *typ. cons.*
ETYMOLOGY. From the Greek *dendron* (tree) and *bios* (life), in reference to the epiphytic habit of the genus.

Key to species

1. **Leaf sheaths not conspicuous** 2
+ **Leaves with distinct basal sheaths** 6

2. **Pseudobulbs with 1 terminal leaf** 3
+ **Pseudobulbs with more than 1 leaf** 4

3. Pseudobulbs appressed to substrate, 1.5–2cm long; 1- or 2-flowered .... **3. D. jenkinsii**
+ Pseudobulbs erect, 6–7cm long; 8- to many-flowered .... **4. D. lindleyi**

4. Sepals and petals white to pink .... **2. D. farmeri**
+ Sepals and petals yellow 5

5. Lip base not blotched or striped with red, margins flat .... **1. D. densiflorum**
+ Lip base blotched or striped with red, margins incurved .... **5. D. sulcatum**

6. Leaf sheaths with dark-brown to blackish hairs 7
+ Leaf sheaths lacking dark hairs 8

7. Apical lobe of lip not fimbriate; mentum less than 1.5cm long; flowering May **26. D. formosum**
+ Apical lobe of lip fimbriate; mentum more than 1.5cm long; flowering August to December **27. D. longicornu**

8. Leaves overlapping, laterally flattened 9
+ Leaves not overlapping or laterally flattened 11

9. Upper half of stem leafless (bearing sheaths or rudimentary leaves only) .... **35. D. spatella**
+ Upper half of stem bearing leaves 10

10. Flowers yellow to greenish-yellow .... **34. D. anceps**
+ Flowers white or light purple .... **36. D. terminale**

11. Stems lacking swollen internodes .... **37. D. cathcartii**
+ Stems with swollen internodes 12

12. Plants tufted; stem internodes few; peduncle and rachis more than 2cm; inflorescence usually more than 6-flowered; flowers usually less than 1.5cm across 13
+ Plants not tufted; stem internodes many; peduncle and rachis less than 2cm long; inflorescence usually fewer than 6-flowered; flowers usually more than 1.5cm across 17

13. Stems pseudobulbous; plants less than 10cm tall 14
+ Stems not pseudobulbous; plants more than 10cm tall 15

14. Plants flowering from leafless stems, November to January .... **31. D. peguanum**
+ Plants flowering from leaf-bearing stems, May to July .... **32. D. porphyrochilum**

15. Lateral lobes of lip entire or wavy .... **28. D. darjeelingense**
+ Lateral lobes of lip deeply serrate 16

16. Dorsal sepal more than 1.7cm long; mentum c.3mm long .... **29. D. denudans**
+ Dorsal sepal less than 1cm long; mentum c.8mm long .... **30. D. eriiflorum**

17. Mentum long, narrow, spur-like .... **33. D. cumulatum**
+ Mentum short, saccate 18

18. Flowers more than 2cm long; racemes pendent, arising from upper part of stem, or from nodes in a regular manner 19
+ Flowers less than 2cm long; racemes short or capitate, arising from nodes in an irregular manner 34

19. Sepals and petals golden-yellow to pale yellow 20
+ Sepals and petals pinkish-purple or white 27

20. Lip margins strongly plumose-fimbriate 21
+ Lip margins not strongly plumose-fimbriate (erose, dentate or ciliate) 22

21. Lip with a single central purple blotch; flowering April to May .... **14. D. fimbriatum**
+ Lip with two purple blotches; flowering July to October .... **17. D. hookerianum**

22. Lip slipper-shaped .... **18. D. moschatum**
+ Lip not slipper-shaped 23

23. Inflorescence 5- to 15-flowered 24
+ Inflorescence 1- to 5-flowered 25

24. Stem covered by large, overlapping bracts at base; floral bracts more than 1.2cm long; leaves obtuse to emarginate; lip lacking distinct blotches .... **10. D. chryseum**
+ Stem with small bracts at base; floral bracts less than 1cm long; leaves acuminate; lip with 2 distinct purple blotches .... **15. D. gibsonii**

25. Lip trowel-shaped .... **16. D. heterocarpum**
+ Lip not trowel-shaped 26

26. Flowers deep golden-yellow; flowering July to October .... **9. D. chrysanthum**
+ Flowers pale primrose-yellow; flowering April to May .... **20. D. ruckeri**

27. Sepals and petals pure white, faintly purple-flushed on outside of sepals .... **8. D. candidum**
+ Sepals and petals white with pink to purple tips to sepals and petals 28

28. Stems erect 29
+ Stems pendent 31

29 Lip simple .... **19. D. nobile**
+ Lip obscurely 3-lobed 30

30. Lip lacking a purple patch at base .... **6. D. amoenum**
+ Lip with a purple patch at base .... **21. D. transparens**

31. Stems branched, slender, knobbly along length .... **13. D. falconeri**
+ Stems unbranched, not as above 32

32. Lip uniformly pale yellow .... **7. D. aphyllum**
+ Lip with a central pale yellow area 33

33. Lip margins entire .... **11. D. crepidatum**
+ Lip margins deeply fimbriate .... **12. D. devonianum**

34. Lip densely fimbriate-pubescent 35
+ Lip not fimbriate-pubescent 36

35. Sepals and petals white with purple margins .... **24. D. praecinctum**
+ Sepals and petals pure white .... **25. D. stuposum**

36. Flowers pale purple; anther dark purple; inflorescence zigzag .... **22. D. aduncum**
+ Flowers yellow; anther white; inflorescence subcapitate .... **23. D. bicameratum**

Section **Densiflora** Finet in Bull. Mus. Hist. Nat. (Paris) 9: 301 (1903).

The sectional name *Densiflora* predates *Callista* (Loureiro) Schltr. and therefore has priority. Brieger (1981) re-established *Callista* as a genus but Schelpe (1981) and Seidenfaden (1985) preferred to retain its sectional rank.

1. D. **densiflorum** Lindl., Gen. Sp. Orchid. Pl.: 90 (1830). Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 2000 (holo. K-LINDL!, iso. K-W!).

Dendrobium clavatum Roxb., Hort. Bengal. 63 (1814), *nom. nud.*; Fl. Ind. ed. 1832: 481 (1832). India, Garrow Hills, [icon. of] '*Dendrobium clavatum*' Roxburgh 2354 (holo. CAL, iso. K!).
Callista densiflora (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic or lithophytic, 30–45cm tall; *roots* fasciculate, thick, c.3mm across. *Stems* strongly clavate, swollen and ± pseudobulbous at base, obscurely 4-angled, yellow, sheathless; internodes clavate, expanding to a swollen node, 3.5–7 × 0.4–1.6cm. *Leaves* 3 or 4 on upper part of stem, oblong-lanceolate to broadly elliptic-ovate, acute, narrowed and shortly petiolate at base, prominently veined, jointed, 12–16 × 2.6–6cm. *Inflorescence* pendent, axillary, densely many-flowered; peduncle sheathed at base, 4–4cm long; sheaths 2 or 3, 0.6–1.9cm long; rachis 6–16cm long; floral bracts, broadly oblong, strongly veined, membranous, revolute, 0.7–1.2 × 0.5–1.2cm. *Flowers* membranous, 3–4cm across; sepals and petals pale yellow, lip rich orange, paler towards margins; pedicel and ovary slender, 2.7–3.3cm long. *Dorsal sepal* ovate-elliptic, rounded, 7-veined, 1.8 × 1.2cm; *lateral sepals* elliptic, acute to subacute, adnate at base to form a mentum, 1.8–2 × 0.9–1cm; *mentum* broad, conical, 6mm wide. *Petals* ovate-orbicular, shortly clawed, 7-veined 1.4–2.2 × 1.1–1.8cm. *Lip* simple, clawed at base, orbicular-rhombic, convolute basally, spreading apically, surface glandular-pubescent, margins slightly revolute, lacerate, 1.6–2.6 × 1.5–2.7cm (when spread). *Column* broad, 7mm long; anther cap c.2.5mm wide. *Fruit* clavate, 3.5–4.5 × 0.6–1cm. **Plate 20.**

Bhutan: S – Gaylegphug district (Gaylegphug); C – Punakha (Bhotokha) and Tashigang (Gongo, 7km before Tashi Yangtsi) districts; **Darjeeling** (Kalimpong); **Sikkim** (below Gangtok, Lower Rangpo Chhu, Pakhyong, Pemayangtse, above Rongnek Chhu). In broad-leaved riverine and wet forest, on *Rhododendron* sp. and *Lithocarpus elegans*, rarely on rocks; 330–2000m. Fl. April–July.

GENERAL DISTRIBUTION. Nepal, India, Myanmar, China and Thailand.
ETYMOLOGY. From the Latin *densus* (dense) and *flos* (flower).
NOTES. King & Pantling (1898) noted that the unexpanded racemes had a 'curious cone-like appearance, which occurs in no other *Dendrobium*'. This is caused by the flower buds being concealed by the floral bracts. *D. densiflorum* is related to *D. thyrsiflorum* Rchb. f. ex E. André but differs in that the sepals and petals are white or pale pink in the latter species. However, Tsi (1980) and other Chinese authors treated them as conspecific. Pradhan (1979) described a rare variation from Darjeeling called *D. densiflorum* var. *alba* Hort. with pure white sepals and petals; we have not seen and cannot comment on this variety.

2. D. **farmeri** Paxton in Paxton's Mag. Bot. 15: 241 + fig. (1849). Type: imported from India, (holo. [icon. in] Paxton's Mag. Bot. 15: 241 + fig. (1849)!).
Callista farmeri (Paxton) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, erect, 20–25cm tall. *Stem* pseudobulbous, clavate-fusiform, broadly 4- or 5-ridged, narrowed towards base, with several nodes, 10–21 × 1.3–2cm (at apex). *Leaves* 2 or 3, subterminal from pseudobulb, ovate-lanceolate to elliptic-lanceolate, acute, coriaceous, many-veined, narrowed to subsessile base, jointed, 10.5–13.5 × 3.2–5.9cm. *Inflorescence* axillary, decurved, pendent, many-flowered; peduncle sheathed, glabrous, 3–3.5cm long; sheaths overlapping at base, distant above, obovate, obtuse, 0.45–1 × 0.45–0.65cm; rachis glabrous, 10–17cm long; floral bracts lanceolate, acute, revolute, 3-veined, 0.8–1.1 × 0.2–0.3cm. *Flowers* 2–4cm across; sepals and petals mauve changing to white, lip deep yellow with pale yellow to white margins; pedicel and ovary slender, puberulent, 2.5–3.5cm long. *Sepals* subsimilar, ovate-oblong, acute, 5-veined, 1.8–2.2 × 0.7–1cm; *lateral sepals* adnate at base to form a mentum with the column foot; *mentum* short, rounded. *Petals* suborbicular, obtuse, shortly clawed at base, 1.6–2 × 1–1.3cm. *Lip* simple, clawed, orbicular to broadly subquadrate, pubescent, margin erose, 1.6–2.3 × 1.5–1.6cm. *Column* with a foot, 6–7mm long. *Fruit* fusiform, 5–6 × 1–1.4cm.

Sikkim (unlocalised *Pantling* specimens). In tropical valleys. Fl. and Fr. April–May.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand, Vietnam and Malaysia.
ETYMOLOGY. Named after W.F.G. Farmer who imported the plant from the Calcutta Botanic Garden and flowered it at his home in Nonsuch Park, Surrey, England.

3. D. jenkinsii Wall. ex Lindl. in Bot. Reg. 25: t.37 (1839). Type: India, Assam, Gualpara, *Jenkins* s.n. (holo. K-LINDL!).
Dendrobium aggregatum var. *jenkinsii* (Wall. ex Lindl.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 61, t.85 (1898).
D. marseillei Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 6(1): 119 (1934). Type from Laos.
Callista aggregata var. *jenkinsii* (Wall. ex Lindl.) Brieger in Schlechter, Orchideen 3(1): 704, t.517 (1981).

Plant epiphytic or lithophytic, 6–7cm tall; roots fasciculate. *Pseudobulbs* aggregated, appressed to substrate, ovoid, 4-angled, compressed, ridged, 1.5–2cm long. *Leaf* 1, apical from pseudobulb, oblong-ovate, obtuse, shortly petiolate, 1.5–2.8 × 0.5–0.8cm. *Inflorescence* lateral from pseudobulb, 1- or 2-flowered; peduncle glabrous, 1.4cm long; floral bract membranous, lanceolate, acute, 1.5–2.5 × 0.4–0.55mm. *Flower* 4cm long, uniformly yellow-orange; pedicel and ovary slender, 4–5cm long. *Dorsal sepal* oblong-elliptic, obtuse, 5-veined, 1–1.2 × 0.5–0.6cm; *lateral sepals* adnate at base to form a mentum, narrowly ovate-elliptic, obtuse, 5-veined, 1.3–1.4 × 0.4–0.5cm; *mentum* 4–5mm wide. *Petals* elliptic-ovate to orbicular, 5-veined, 1–1.6 × 0.5–0.9cm. *Lip* simple, transversely obcordate, margins erose, surface pubescent centrally, 1.5–2.2 × 1.7–2.8cm (when spread). *Column* thick, 6mm long. **Plate 22**.

Bhutan: S – Deothang district (Samdrup Jhonkar (M.F.B.)); C – Punakha (Bhotokha, between Chusom and Nyatoka, Yuwak to Wangdi Phodrang, 20km S of Wangdi Phodrang) and Mongar (Saling) districts; **Duars** (Jaldacca River). On *Quercus* sp., on N-facing rockface; 1100–1400m. Fl. April–May.

GENERAL DISTRIBUTION. NE India, Myanmar and China.
ETYMOLOGY. Named after Francis Jenkins (1793–1866) who served as a Major-General in the Bengal Army and collected plants for N. Wallich.
NOTES. Hooker (1890) and King & Pantling (1898) observed this species growing together with *D. lindleyi* and considered them to be conspecific. Schelpe (1981) and Seidenfaden (1985) argued that they were distinct and we follow this treatment here. Seidenfaden (1985) illustrated a specimen from Laos (*Tixier* VI) at Kew that shows the lip surface papillose to the margins, but in the type specimen the lip is papillose only centrally.

4. D. lindleyi Steudel, Nomencl. Bot. ed.2: 490 (1840). Type: Myanmar (Burma), Arakan, *Pierard*, [icon. of] '*Dendrobium aggregatum*' Roxburgh 1289 (holo. CAL, iso. K!).
Dendrobium aggregatum sensu Roxb., Fl. Ind. ed. 1832: 477 (1832), non Kunth (1816).
Callista aggregata (Roxb.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, erect to subpendent, pseudobulbous, 24–35cm tall. *Pseudobulbs* ovoid-fusiform, rugose-grooved, aggregated, yellowish, fibrous-sheathed with age, 6–7 × 0.6–1.4cm. *Leaf* 1, apical from pseudobulb, oblong-elliptic, obtuse-emarginate, jointed, sheathless, shortly petiolate, 8–12 × 2–2.6cm; petiole 0.8–1.3cm long. *Inflorescence* axillary, 8- to many-flowered; peduncle glabrous, sheathed, 7–12cm long; sheaths membranous, distant, 3–5mm long; rachis glabrous, 10–21cm long; floral bracts triangular-lanceolate, acute, membranous, 2–4 × 1–1.5mm. *Flowers* 1–4cm across, pale yellow to yellow, lip with deeper yellow-orange base; pedicel and ovary slender, 3–4.2cm long. *Sepals* subsimilar, ovate, obtuse, 5-veined, 1–1.2 × 0.4–0.8cm; *lateral sepals* adnate at base to form a mentum; *mentum* broadly conical, 2.5–3.5cm wide. *Petals* shortly clawed, suborbicular, 5-veined, 1.1–1.3 × 0.8–1.1cm. *Lip* simple, transversely obcordate, glandular-pubescent centrally, margins entire to weakly erose, undulate, 1.6–2.4 × 1.6–2.5cm. *Column* with a foot, 6–7mm long. *Fruit* cylindric, grooved, 5.5–6 × 0.4–0.5cm.

Sikkim (King & Pantling, 1898). On *Lagerstroemia hirsuta*; 1000–1500m. Fl. February–March.

GENERAL DISTRIBUTION. India, Myanmar, China, Thailand, Laos and Vietnam.

ETYMOLOGY. Named after John Lindley (1799–1865).

NOTES. King & Pantling (1898) reported *D. aggregatum* growing together with *D. jenkinsii* in Sikkim. They treated the plants as conspecific (see note under *D. jenkinsii* above). It has also been reported from Bhutan by Würmli (1973) but this collection has unfortunately been lost. The local material that we have seen is all referrable to *D. jenkinsii*.

5. **D. sulcatum** Lindl. in Bot. Reg. 24: t.65 (1838). Type: India, Gibson, cult. Chatsworth (holo. [icon. in] Bot. Reg. 24: t.65 (1838)!).

Callista sulcata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, erect, 25–40cm tall. *Stems* pseudobulbous, clavate, compressed, grooved, narrowed towards base, yellow, nodes several, 14–27 × 1–2.5cm (at widest point); internodes 2.8–5.5cm long. *Leaves* 3 or 4, subterminal, distichous, broadly elliptic to elliptic-ovate, acute, sessile, 10–17 × 3.5–5.5cm. *Inflorescence* axillary, adjacent to leaf, subdensely 5- to 10-flowered; peduncle sheathed, 2.5–3cm long; sheaths overlapping at base, distant above, ovate, subacute, 3-veined, membranous, 3.5–5 × 2–3mm; rachis short, 0.5–3.5cm long; floral bracts ovate, acute, membranous, 3-veined, 3–4 × 2–3mm. *Flowers* 3–4cm across, uniformly golden-yellow, lip with red-purple markings or stripes at base; pedicel and ovary slender, 1–1.2cm long. *Sepals* subsimilar, oblong, subacute, 5-veined, 1.7–2.2 × 0.5–0.95cm; *lateral sepals* adnate at base to form a mentum; *mentum* short, obtuse, 3–4.5mm wide. *Petals* suborbicular, obtuse, concave, 5-to 7-veined, 1.7–1.9 × 0.7–1.1cm. *Lip* simple, suborbicular to wedge-shaped, shortly clawed, emarginate, incurved, pubescent around marginal area, margin minutely erose, 1.8–2 × 1.4–2.1cm (when spread). *Column* broad, 7–8mm long; anther cap c.3mm wide.

Darjeeling (unlocalised *Gamble* specimen); **Sikkim** (unlocalised *Pantling* specimen). In tropical valleys; 2330m. Fl. April–July.

GENERAL DISTRIBUTION. NE India, Myanmar and Laos.

ETYMOLOGY. From the Latin *sulcatus* (grooved), a reference to the stems.

Section **Dendrobium**

6. **D. amoenum** Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 78 (1830). Type: Nepal, icon. Wallich 674 (holo. K!).

Dendrobium egertoniae Lindl. in Bot. Reg. 33: sub t.36 (1847). Type: India, without provenance, cult. Egerton (holo. K-LINDL!).

D. mesochlorum Lindl., loc. cit. (1847). Type: India, without provenance, cult. Veitch [icon] (holo. K-LINDL!).

Callista amoena (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, 15–40cm tall. *Stems* slender, thickened at nodes, erect to suberect; internodes yellowish, sheathless, 1.8–4.2cm long. *Leaves* oblong-lanceolate, acute, oblique, sessile, 6.5–11.5 × 0.6–1.9cm. *Inflorescence* lateral, on leafless stem, 1- or 2-flowered; peduncle short, sheathed at base, 6mm long; sheath membranous, tubular, c.4mm long; floral bracts membranous, ovate, 3.5–9mm long. *Flowers* fragrant (of violets), 2–4cm across; sepals and petals white-tipped or flushed with violet, lip white flushed with yellow or greenish-yellow centrally and an apical purple spot, or purple-spotted, mentum violet, column greenish; pedicel and ovary slender, 1.6–2.8cm long. *Sepals* similar, oblong-lanceolate, obtuse to acute, 7-veined, 1.9–2.3 × 0.5–0.7cm; mentum conical, 4–7 × 1.5–3mm. *Petals* ovate, obtuse to acute, 5-veined, 2–2.5 × 0.5–0.9cm. Lip obscurely 3-lobed, clawed at base, oblong-obovate (when spread), 1.8–2.6 × 0.8–1.7cm; lateral lobes broad, rounded, convolute; mid-lobe orbicular, margins undulate to shortly fimbriate, puberulous; disc sub-villous. *Column* broad at apex, 0.8–1cm long; foot tapering.

Bhutan: C – Punakha (Wangdi Phodrang (field record)) and Tongsa (Between Berthi and Shemgang (M.F.B.)) districts; **Darjeeling** (Kalimpong, Kurseong, Sureil); **Sikkim** (unlocalised Hooker, Kurz and Pantling specimens). In tropical valleys, in oak and *Schima* forest; 660–1660m. Fl. May–June.

GENERAL DISTRIBUTION. India (Himalayas) and Nepal.
ETYMOLOGY. From the Latin *amoenus* (delightful, pleasing).

7. **D. aphyllum** (Roxb.) C.E.C. Fischer in Gamble, Fl. Madras 3: 1416 (1928). Type: India, Coromandel, [icon. of] '*Limodorum aphyllum*' Roxburgh 241 (holo. CAL, iso. K!).

Limodorum aphyllum Roxb., Pl. Coromandel 1: 34, t.41 (1795).
Cymbidium aphyllum (Roxb.) Sw. in Kongl. Vetensk.. Acad. Nya. Handl. 6: 73 (1799).
Dendrobium cucullatum R. Br. in Bot. Reg 7: t.548 (1821). Type without provenance.
D. pierardii Roxb. ex Hook., Exot. Fl. 1: t.9 (1822). Type based on icon. Roxburgh cited above.
D. pierardii var. *cucullatum* (R. Br.) Hook. f., Fl. Brit. India 5(2): 738 (1890).
Callista aphylla (Roxb.) Kuntze, Revis. Gen. Pl. 2: 653 (1891).
Dendrobium madrasense A.D. Hawkes in Orquídea (Rio de Janeiro) 25(3): 102 (1963), *nom. superfl.*
D. aphyllum var. *cucullatum* (Hook. f.) Sarkar in J. Econ. Taxon. Bot. 5(5): 1007 (1984).

Plant epiphytic; 22–65cm long; *roots* fasciculate. *Stems* pendent, slender, expanded at nodes; internodes sheathed, 1.6–2.5cm long; sheaths funnel shaped. *Leaves* lanceolate to ovate-lanceolate, subacuminate, sessile, distichous, 4.5–10 × 0.4–3cm. *Inflorescence* lateral, arising from nodes of old stems, 1-flowered; peduncle attenuate; floral bract ovate, scarious, 4–5mm long. *Flower* fragrant, 2–5cm across; sepals and petals pink to pale purple, lip pale yellow with purple lines basally; pedicel and ovary slender, 1.5–2cm long. *Sepals* subequal, oblong-lanceolate, subacute, 5-veined; *dorsal sepal* 2.4 × 0.5cm; *lateral sepals* adnate at base to form a mentum, 2.5 × 0.4cm; *mentum* short, obtuse, 4 × 2mm. *Petals* ovate-lanceolate to elliptic, obtuse, 5-veined, 2.1–2.4 × 0.9–1cm. Lip shortly clawed, broadly suborbicular (when spread), simple, margins erose basally becoming ciliate towards apex, pubescent, convolute over the column, 2.5–2.6 × 1–2.1cm. *Column* 6–7mm long (with foot). Fruit clavate, cylindric, 3–6 × 0.6–0.9cm. **Plate 19.**

Bhutan: S – Samchi (Tamangdhanra), Phuntsholing (Kamji, Phuntsholing), Sarbhang (Phipsoo Khola, near Sarbhang Khola), Gaylegphug (Gaylegphug) and Deothang (Samdrup Jhonkar (M.F.B.)) districts; C – Punakha (Bhotokha); **Terai** (Sivok, Sukna); **Darjeeling** (Kalimpong, Kurseong, Mongpu, below Pedong, Punkhabari); **Sikkim** (Dikchu, Gangtok, Lower Rangpo Chhu, Namphak, Pemayangtse). On trees on river banks in subtropical and open forest; 340–1660m. Fl. March–June; Fr. April.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China, Thailand, Vietnam to Malaysia.
ETYMOLOGY. From the Greek *a-* (without) and *phyllon* (leaf) in reference to the absence of leaves during flowering.
NOTE. Seidenfaden (1985) reviewed the history and taxonomy of this species.

8. **D. candidum** Wall. ex Lindl. in Bot. Reg. 24: misc.36, no.54 (1838). Type: India, Nungclow, Khasia Hills, Gibson s.n. (holo. K-LINDL!).
Dendrobium spathaceum Lindl., in J. Proc. Linn. Soc., Bot. 3: 15 (1859). Type: India, Sikkim, Hooker 143 (holo. K-LINDL!, iso. K!).
Callista candida (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).
C. spathacea (Lindl.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).
Dendrobium officinale Kimura & Migo in J. Shanghai Sci. Inst. sec.3,3: 122, t.6a,7,9 (1936). Type from China.

Plant epiphytic or lithophytic, 21–32cm tall; roots fasciculate. *Stems* slender, erect, cylindric; internodes yellow, covered by old leaf sheaths, 1.1–3.8cm. *Leaves* narrowly lanceolate, obtuse, obliquely emarginate, sessile, prominently 5-veined, borne towards stem apex, 5.3–9.2 × 0.5–1.1cm. *Inflorescence* lateral, flowering on leafless stems (occasionally with leaves), 1- to 3-flowered; peduncle slender, sheathed, 9mm long; sheaths lanceolate, acute, 1-veined, hyaline, 8 × 3mm; rachis weakly zigzag, 9mm long; floral bracts spathulate, acute, membranous, 1-veined, 4 × 2mm. *Flowers* fragrant, 1.5–2.5cm across; sepals and petals white, tinged with pink externally, lip with a yellow spot at base; pedicel and ovary slender, 1.5–1.8cm long. *Sepals* broadly lanceolate, subacute to obtuse, 5-veined, subequal; *dorsal sepal* 1.4–1.8 × 0.2–0.4cm; *lateral sepals* weakly falcate,1.4–1.9 × 0.25–0.4cm; *mentum* broad, rounded, 1.5–2.5 × 2–3mm. *Petals* lanceolate, acute, 3-veined, 1.2–1.3 × 0.3–0.35cm. *Lip* 3-lobed, oblong-lanceolate, shortly clawed, 1,4–1.5 × 0.6–0.8cm; lateral lobes short, rounded, incurved; epichile acute; disc with an elongate callus extending for 3–4mm from base, expanded at apex. *Column* 5–6mm (with foot); foot broad, deeply excavated. *Fruit* ovoid, 1.4–1.6 × 0.9–1cm. **Plate 20.**

Bhutan: S – **Chukka district** (above Chukka Dzong, 2km N of Jumudag); **C** – **Punakha** (Mara Chu Valley, Tinlegang), **Tongsa** (near Dorji Gompa) and **Tashigang** (Gongo, S of Tashi Yangtsi (M.F.B.)) districts; **Darjeeling** (Raman); **Sikkim** (Lachen Valley, Latong, Pemayangtse, Rathong, Singalila). In moss on trees or rocks, in evergreen oak and mixed broad-leaved forest; 1000–2700m. Fl. February–June; Fr. October.

GENERAL DISTRIBUTION. India (Himalayas), Nepal and Myanmar.
ETYMOLOGY. From the Latin *candidus* (shining white) in reference to the flower colour.

9. **D. chrysanthum** Wall. ex Lindl. in Bot. Reg. 15: t.1299 (1830); Gen. Sp. Orchid. Pl.: 80 (1830). Type: Nepal, Cherapang, coll. *Wallich* Wall. Cat. 2012 (holo. K-LINDL!, iso. K! K-W!).
Dendrobium paxtonii sensu Lindl. in Bot. Reg. 25: misc.43, no.56 (1839), non Paxton (1839).
D. chrysanthum var. *microphthalma* Rchb. f. in Gard. Chron. n.s., 11: 366 (1879). Type without provenance.
D. chrysanthum var. *anophthalma* Rchb. f., op. cit. 19: 44 (1883). Type without provenance.
Callista chrysantha (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic or lithophytic, pendent, 60–100cm long; roots fasciculate, 2–3mm thick. *Stem* pendent, straight to wavy, internodes covered by sheaths, yellowish beneath; internodes 2–3.5cm long. *Leaves* distichous, elliptic-lanceolate, acute to acuminate, sessile, with 5–7 prominent veins, 5.5–21 × 1.5–4.5cm. *Inflorescence* lateral, leaf-opposed, fasciculate, on leafy or leafless stems, 2- to 4-flowered; peduncle attenuate, covered by membranous sheaths; floral bracts membranous, ovate, obtuse, 6–7mm long. *Flowers* fleshy, 1.5–2.5cm across, golden yellow, lip with two separate or confluent deep purple spots; pedicel and ovary slender, 2.5–5cm long. *Sepals* subequal, oblong-elliptic to ovate, subacute, concave, 1.2–2.9 × 0.5–0.9cm; *lateral sepals* weakly falcate; *mentum* short, wide, obtuse, 2–3mm long. *Petals* elliptic to ovate-orbicular, obtuse, 1.2–3.1 × 0.8–1.3cm. Lip simple, clawed at base and enclosing the column, epichile broadly orbicular-oblong to reniform, concave, pubescent to tomentose, margins shortly fimbriate-dentate, 1.7–2.5 × 1.6–1.9cm. Column 8–9mm long (with foot). Fruit ovoid-pyriform, long-stalked, 2.5–4.5 × 1.5–2.2cm. **Plate 20.**

Bhutan: S – Phuntsholing (Phuntsholing) and Chukka (Raidak Valley, Tabji Khola) districts; **C** – Punakha (Lometsawa, near Wache), Tongsa (Shemgang) and Tashigang (near Tashigang (M.F.B.)) districts; **N** – Upper Mo Chu district (Tamji); **Darjeeling** (Bamanpokhri, Happy Valley, Kalimpong, Lodhoma Khola, Rishep, Rishihat, Sureil); **Sikkim** (Chongpung, Pemayangtse, Yoksam). In warm broad-leaved forest, on N-facing slopes; 900–2160m. Fl. February–October; Fr. May–July.

GENERAL DISTRIBUTION. India (Himalayas), Nepal, Myanmar, China, Thailand, Laos and Vietnam.

ETYMOLOGY. From the Greek *chryso-* (golden-yellow) and *anthos* (flower).

NOTE. *D. chrysanthum* is related to *D. ochreatum* Lindl. and the differences, which are slight, were discussed by Seidenfaden (1985).

10. D. chryseum Rolfe in Gard. Chron. ser.3, 3: 233 (1888). Type: India, Assam, cult. Veitch (holo. K!).

Dendrobium clavatum Wall. ex Lindl. in Paxton's Fl. Gard. 2: 104, no.379, f.189 (1852). Type: India, Assam, cult. T. Denne (holo. K-LINDL!).

Callista clavata (Wall. ex Lindl.) Kuntze, op. cit. 654 (1891).

Dendrobium tibeticum Schltr. In Feddes Reprt. Spec. Nov. Regni Veg. 17: 68 (1921). Type: China, Xizang, Monbeig s.n. (holo. B).

D. clavatum var. *aurantiacum* (Rchb. f.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 40 (1951).

Plant epiphytic, 30–50cm tall. *Stems* erect to arching, sheathed, yellowish, leafy or leafless; sheaths enclosing internodes, shortening towards apex, 2–5cm long. *Leaves* oblong-lanceolate, obtuse to subacute or subemarginate, sessile, jointed, coriaceous, 9.5–13.5 × 1.4–3.5cm. *Inflorescence* lateral, arising from leafless stem, 2- or 3-flowered; peduncle sheathed, 4–6cm long; sheaths 2 or 3, tubular to funnel shaped, overlapping, 1.4–2cm long; rachis glabrous, 3–10cm long; floral bracts ovate-lanceolate, acute, membranous, 1.4–2.4 × 0.3–0.5cm. *Flowers* 2.5–6cm across, uniformly yellow-orange, lip with a large, confluent 2-lobed purple blotch; pedicel and ovary slender, 2–5cm long. *Sepals* similar, lanceolate to oblong-lanceolate, subacute, 1.8–3.2 × 0.6–0.9cm; *mentum* short, obtuse, 5–6 × 4–5mm. *Petals* broadly elliptic-spathulate, subacute, 2–3 × 1–1.6cm. Lip simple, narrowed and clawed at base, orbicular-reniform, concave, minutely pubescent to tomentose, margin shortly fimbriate, 1.4–2.4 × 0.9–2cm. *Column* 5–8mm long.

Bhutan: C – Punakha district (Punakha to Wangdi Phodrang (field record)); **Sikkim** (Tendong (King & Pantling, (1898)). In broad-leaved forest, on rocks by waterfall in riverine forest; 1500–2000m. Fl. June.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China, Thailand, Laos and Vietnam.

ETYMOLOGY. From the Greek *chryseus* (golden-yellow), a reference to the flower colour.

NOTES. King & Pantling (1898) reported this species as *D. clavatum* Lindl., which Seidenfaden (1985) reduced to the synonymy of *D. chryseum*. We have seen no material of this species from our area.

11. D. crepidatum Lindl. & Paxton in Paxton's Fl. Gard. 1: 63, t.45 (1850). Type: India, cult. P. Bassett, icon. Bassett (holo. K-LINDL!).

Callista crepidata (Lindl. & Paxton) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, 15–30cm tall; *roots* densely clustered. *Stems* clustered, curved, terete, jointed, straight to weakly zigzag, yellow, covered by tubular, scarious sheaths; internodes 1.8–2cm long; sheaths broadly ovate, striate,1.1–2cm long. *Leaves* few, oblong-lanceolate, acuminate, distichous, many-veined, sessile, jointed, 6–14.5 × 0.7–2.4cm. *Inflorescence* lateral, arising from slightly swollen nodes, leafless at flowering, 1- or 2-flowered; peduncle attenuate, 1–2mm long; floral bracts not seen. *Flowers* 2–2.5cm across; sepals and petals white with a pinkish blush at apices, lip white with a large yellow central area, pink at apex; pedicel and ovary glabrous, 2.5–2.8cm long. *Sepals* similar, elliptic-lanceolate, acute, 5-veined, 1.4–2 × 0.5–0.6cm; *mentum* c.2mm long. *Petals* broadly ovate, obtuse, margins entire, 5-veined, 1.2–1.8 × 0.7cm. *Lip* simple, shortly clawed, broadly obovate, base with incurved sides, glandular-papillose above and beneath, margins weakly undulate, entire, 1.2–1.7 × 0.9–1.5cm. *Column* 7–8mm long. *Fruit* ovoid, erect, 1.5–2 × 0.5–1cm.

Sikkim (unlocalised *Pantling* specimens). In tropical valleys; 1160m. Fl. and Fr. May.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China, Thailand, Laos and Vietnam.

ETYMOLOGY. From the Latin *crepida* (a shoe or slipper) and *-atus* (indicating a likeness).

NOTES. This species occurs in two forms: one with normal flowers, the other with smaller, more or less actinomorphic, cleistogamous flowers. The latter, which was described as *D. lawanum* Lindl., is the usual form in Sikkim, but the two types can occur together (Seidenfaden, 1985).

12. D. devonianum Paxton in Paxton's Mag. Bot. 7: 169 + fig. (1840). Type: India, Khasia, *Gibson* s.n. (holo. [icon. in] Paxton's Mag. Bot. 7: 169 + fig. (1840)!).

Dendrobium pictum Griff. ex Lindl. in J. Proc. Linn. Soc., Bot. 3: 12 (1859), *nom. nud.*

D. pulchellum sensu Lindl., *loc. cit.* (1859), *non* Roxb. ex Lindl.

D. pulchellum var. *devonianum* (Paxton) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 284 (1861).

Callista devoniana (Paxton) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic or lithophytic, 30–50cm tall; *roots* fasciculate. *Stem* elongate, slender, swollen at base, erect or weakly zigzag, often pendent at apex, jointed, glabrous, bearing alternate leaves; internodes 2–4cm long. *Leaves* ovate-lanceolate to linear-lanceolate, acute to acuminate, sessile, sheathing at base, 4–9 × 0.6–1.5cm; sheaths tubular, 2–4cm long. *Inflorescence* lateral, arising from nodes, clustered, 1- to 3-flowered; peduncle short; floral bracts lanceolate, acute, membranous, 4–5 × 1–2mm. *Flowers* 2–4cm long and wide; sepals cream to white, purple-tinged, petals cream to white with pink-purple towards apex, lip cream or white tinged with pink, yellow in centre; pedicel and ovary slender, glabrous, 2–3cm long. *Sepals* similar, oblong-lanceolate, acute, 5-veined, 2–2.9 × 0.5–0.8cm; *lateral sepals* adnate at base to form a mentum; *mentum* 4mm long. *Petals* lanceolate-ovate, acute, margins fimbriate, 2–2.5 × 0.8–1cm. *Lip* simple, orbicular-cordate, shortly clawed at concave base, margins deeply fimbriate, 2–2.8 × 2–3.5cm. *Column* erect, c.7mm long, widening and 2-winged towards apex. **Plate 21.**

Bhutan: S – Chukka district (3km S of Chima Kothi); **C** – Punakha (Bhotokha, S side of Tang Chu, Wangdi Phodrang), Tongsa (Khosela) and Mongar (Thrumsing La) districts. On *Quercus lamellosa* and *Citrus reticulata* trees, S-facing slopes and on rocks; 800–2050m. Fl. (April–)May–August.

GENERAL DISTRIBUTION. NE India, Myanmar, China and Thailand.

ETYMOLOGY. Named after William, 6th Duke of Devonshire (1790–1858) for whom the species was collected.

13. D. falconeri Hook. in Bot. Mag. 82: t.4944 (1856). Type: 'Bhutan', cult. *G. Reid* (holo. K!).

Callista falconeri (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Dendrobium erythroglossum Hayata, Icon. Pl. Formos. 4: 36, t.13a (1914). Type from Taiwan.

Plant epiphytic, pendent. *Stem* long, slender, branched, pendent, jointed, bearing few leaves from the bead-like nodes; internodes ridged, 1–2.5mm thick, tubular-sheathed, 1–2cm long. *Leaves* few, linear-oblong, subacute, jointed with internode sheath, sessile, many-veined, 3–8 × 0.15–0.4cm. *Inflorescence* lateral, arising from nodes, 1 flower from each peduncle (occasionally a second peduncle arising with the pedicel creating a 2-flowered inflorescence); peduncle short, glabrous, sheathed at base, 1–2.8cm long; sheath 1, tubular, 4–6mm long; floral bracts ovate, obtuse, membranous, 5–6mm long. *Flowers* 3.4–5cm long; sepals and petals pale pink tipped with purple, lip white with a central dark purple spot surrounded by a yellow-orange ring, apex purple; pedicel and ovary slender, glabrous, 1.5–1.8cm long. *Sepals* spreading, oblong-lanceolate, acuminate, sometimes twisted, 7-veined, 4–5 × 0.8–1.2cm; *lateral sepals* adnate at base to form a spur-like mentum; *mentum* 5–6mm long. *Petals* elliptic-ovate, acute to acuminate, 9-veined, 3.8–5 × 1.1–1.6cm. *Lip* obscurely 3-lobed, shortly clawed and hooded at base, broadly cordate-orbicular, apex acute, softly ciliate, margins dentate-serrate to fimbriate, 3–4.9 × 1.8–3.5cm. *Column* 3–5mm long; stelidia 2, horn-like; anther cap hemispheric, dentate at apex, glandular-pubescent. **Plate 22.**

Bhutan: S – Deothang district (Narfong (M.F.B.)); C – Punakha (Mara Chu Valley, near Tinlegang), Tongsa (between Changkha and Tongsa, 7km S of Shemgang, near Tashiling), Mongar (Saling), Punakha to Wangdi Phodrang (field record) and Tashigang (Balfi, 7km before Tashi Yangtsi) districts. On oak and other trees, hanging in clusters in full sun, in wet valleys, in *Quercus griffithii* and *Rhododendron arboreum* forest; 1660–2500m. Fl. (March–)May–June.

GENERAL DISTRIBUTION. NE India, Myanmar and China.
ETYMOLOGY. Named after Hugh Falconer (1808–1865), Superintendent of the Saharanpur Botanic Garden (1832–1842), who collected plants in India.

14. D. fimbriatum Hook., Exot. Fl. 1: t.71 (1823). Type: Nepal, without precise locality, coll. *Wallich* Wall. Cat. 2011 (holo. K-LINDL!, iso. K! K-W!).

Dendrobium paxtonii Paxton in Paxton's Mag. Bot. 6: 169 + fig. (1839). Type: India, Khasia, Gibson, cult. Chatsworth (holo. [icon. in] Paxton's Mag. Bot. 6: 169 + fig. (1839)!).

D. normale Falconer in Ann. Nat. Hist. 3: 196 (1839); Proc. Linn. Soc. Lond. 1: 14 (1839). Type: India, *Falconer* 1004 (holo. W! Herb. no. 40042), *nom. nud.*

D. fimbriatum var. *oculatum* Hook. in Bot. Mag. 71: t.4160 (1845). Type: Nepal, *Wallich* 2011 cited above.

Callista oculata (Hook.) Kuntze, Revis. Gen. Pl. 2: 653 (1891).

C. normalis (Falconer) Kuntze, op. cit. 655 (1891).

Plant epiphytic or lithophytic, to 120cm long. *Stems* erect, arching to pendent, tapering at each end, yellowing, jointed, swollen at base, many-leaved; internodes sheathed, 1.5–4 × 0.5–2cm. *Leaves* oblong-lanceolate to narrowly elliptic-lanceolate, acute to acuminate, many-veined, deciduous, sessile, jointed with internode sheath, 7–15 × 1.4–3cm. *Inflorescences* lateral, arising from nodes, pendent, 6- to 15-flowered; peduncle sheathed at base, glabrous, 3cm long; sheaths 4 or 5, tubular, overlapping, shorter at base, 2–8mm long; rachis glabrous, 6–14cm long; floral bracts triangular, 3–7 × 1.5–2mm. *Flowers* smelling strongly of lemons, 4–5.5cm across; sepals and petals light orange-yellow, lip deep orange-yellow, often with a dark maroon blotch on the disc; pedicel and ovary slender, 1.8–2.4cm long. *Dorsal sepal* oblong-elliptic, obtuse to acute, 2–3 × 1.2–1.8cm; *lateral sepals* obliquely ovate, adnate at base to form a mentum, 2.6–3 × 0.6–1cm; *mentum* short, saccate, 5–6mm long. *Petals* suborbicular to oblong-elliptic, rounded, shortly clawed, 2–3 × 1.4–1.8cm. *Lip* shortly clawed, suborbicular, densely pubescent, margins plumose-fimbriate, 2.5–3.2 × 2–3cm. *Column* 2–3mm long. *Fruit* ovoid, 4–4.3 × 0.9–1.5cm. **Plate 22.**

Bhutan: S – Samchi (Samchi) and Gaylegphug (Thewar Khola) districts; C – Thimphu/Punakha (near Hinglai La), Tongsa (Berthi to Tama (M.F.B.)) and Tashigang (Gamri Chu, near Tashi Yangtsi) districts; **Darjeeling** (unlocalised *Gamble* specimen); **Sikkim** (beside the Gangtok Road, below Pakhyong). In tropical valleys, on damp sandy banks and margins of subtropical forest, on *Quercus griffithii*; 300–3660m. Fl. March–May.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China, Thailand, Laos, Vietnam and Malaysia.
ETYMOLOGY. From the Latin *fimbriatus* (fringed) in reference to the lip margin.

NOTES. Seidenfaden (1985) treated var. *oculatum* (the usual form in our area), which has purple blotches, as conspecific with *D. fimbriatum* which lacks the blotches. We follow this treatment here. This species is closely related to *D. hookerianum* which also has purple blotches, but has longer fimbriae on the lip margin, and flowers later. Hooker (1890) believed that *D. normale* was a monstrous form, but was unable to say of which species; it is now considered to be conspecific with *D. fimbriatum*.

15. **D. gibsonii** Lindl. in Paxton's Mag. Bot. 5: 169 + fig. (1838). Type: India, Khasia, *Gibson* s.n. (holo. K-LINDL!).

Dendrobium fuscatum Lindl. in J. Proc. Linn. Soc., Bot. 3: 8 (1859). Types: India, Sikkim, icon. *Cathcart* (syn. K-LINDL!); Sikkim, *Hooker* 12 (syn. K-LINDL!); Khasia, *Hooker & Thomson* 12 (syn. K-LINDL!).

Callista gibsonii (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Dendrobium fimbriatum var. *gibsonii* (Lindl.) Finet in Bull. Mus. Hist. Nat. (Paris) 9: 299 (1903).

Plant epiphytic or lithophytic, 50–70cm tall. *Stems* swollen at base, pendent, weakly zigzag, jointed, tapering, bearing many alternate leaves; internodes bearing green sheaths, yellowish, nodes swollen and rooting, 2–3cm long. *Leaves* ovate-lanceolate to lanceolate, acute to acuminate, many-veined, sessile, sheathing at base, 5–13 × 0.9–3.2cm. *Inflorescences* lateral, arising from nodes, pendent, 6- to 12-flowered; peduncle slender, glabrous, sheathed, 1–2.5cm long; sheaths 1–3, ovate, acute, tubular, 7–9mm long; rachis slender, glabrous, pendent, 9–13cm long; floral bracts ovate, acute, 6–9 × 2–3mm. *Flowers* 2–2.5cm across, pure yellow to orange-yellow, lip with two round, purple-black spots towards base, column greenish-yellow; pedicel and ovary slender, glabrous, 2–3cm long. *Sepals* subequal, broadly ovate, obtuse, 1.2–2 × 0.4–0.8cm; *lateral sepals* adnate at base to form a mentum; *mentum* broad, 3–5mm long. *Petals* broadly ovate, weakly hooded, obtuse, 1.4–1.5 × 0.7–0.8cm. *Lip* simple, clawed at base, orbicular-reniform, apex broad, papillose, margins shortly erose-fimbriate, 1.4–1.9 × 1.2–1.9cm (when spread). *Column* broad, 7–8 × 3–3.5mm. *Fruit* ovoid, c.5 × 2cm.

Bhutan: S – Gaylegphug district (Surelakha); C – Tongsa district (Mangde Chu, near Yoormu); Sikkim (Tong). In evergreen, lower montane forest, on damp boulders among shrubs and on small trees; 1000–1660m. Fl. May–August.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China and Thailand.

ETYMOLOGY. Named after John Gibson (1815–1875), gardener to the 6th Duke of Devonshire at Chatsworth House in Derbyshire, who collected orchids in NE India.

NOTE. *D. gibsonii* has sometimes been treated as conspecific with *D. fimbriatum*. Seidenfaden (1985) considered it to be distinct on the basis of the colour, the lip margins and the flexuose raceme.

16. **D. heterocarpum** Lindl., Gen. Sp. Orchid. Pl.: 78 (1830). Type: Nepal, icon. *Wallich* s.n. (holo. K!).

Callista heterocarpa (Lindl.) Kuntze, op. cit. 654 (1891).

Plant epiphytic, 20–150cm long; roots clustered. *Stems* fusiform, erect or pendent, widening upwards, swollen at base, caespitose, yellow with age, bearing many, alternate leaves; internodes sheathed, 2–3 × 0.2–1.6cm. *Leaves* oblong-lanceolate to oblong, acute, many-veined, sessile, jointed, 7–11 × 1.1–2cm. *Inflorescences* lateral, arising from nodes once leaves have fallen, 2- or 3-flowered; peduncle short, sheathed, 2–3mm long; sheaths scarious, tubular, c.4mm long; floral bracts scarious, oval, retuse to emarginate or obtuse, 6–9 × 3–4mm. *Flowers* fragrant, long-lived, 4–6cm across, yellow, pale creamy-yellow to cream, lip cream or yellow with a central maroon to crimson blotch or striations, column cream with a yellow base; pedicel and ovary glabrous, slender, 2.1–2.7cm long. *Sepals* oblong-lanceolate, obtuse to acute, 5- to 7-veined, 2.1–4.4 × 0.6–0.8cm; *lateral sepals* adnate to form a mentum; *mentum* obtuse, 4–7mm long. *Petals* ovate, obtuse to acute, 7-veined, 2.4–3.8 × 0.7–1.2cm. *Lip* obscurely 3-lobed, ovate-lanceolate, base wedge-shaped, convolute and hooded around the column, acute and reflexed at apex, margins minutely serrulate-fimbriate, pilose centrally, 2.4–3.7 × 1.1–2.1cm. *Column* 3–4mm long; foot 0.7–0.8mm long. *Fruit* obconical, 2.5–3.5 × 0.9–1.8cm.

Bhutan: S – Sankosh (above Daga Dzong) and Deothang (Satsalor to Kheri Gompa) districts; C – Punakha (Chusom, Dawakha, Punakha to Tinlegang) and Tongsa (Shemgang (M.F.B.)) districts; **Sikkim** (Panlang La). On trees, in tropical valleys; 1300–1800m. Fl. December–May.

GENERAL DISTRIBUTION. Sri Lanka, India, Nepal, Myanmar, China, Thailand, Laos, Vietnam, Malaysia, Sumatra, Java and Sulawesi.
ETYMOLOGY. From the Greek *hetero-* (different) and *carpus* (fruit) in reference to the variable fruit.
NOTE. This is a remarkably variable species that can occur in a number of colour forms.

17. **D. hookerianum** Lindl. in J. Proc. Linn. Soc., Bot. 3: 8 (1859). Type: India, Sikkim, *Hooker* 8 (holo. K-LINDL!).
Dendrobium chrysotis Rchb. f. in Gard. Chron. 1870: 1311 (1870). Type: India, Assam, *T. Moore* (holo. K!).
Callista hookeriana (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic or lithophytic, 30–70cm tall. *Stems* pendent, curved, jointed, slightly swollen at base and at nodes, bearing many alternate leaves, yellowish at nodes; internodes sheathed, 1.5–3 × 0.4–0.6cm. *Leaves* elliptic-lanceolate to oblong-lanceolate, acute to acuminate, sessile, jointed, many-veined, 4–12 × 1.2–3cm. *Inflorescences* lateral, arising from nodes on leafy-stem, 2- to 4-flowered; peduncle sheathed at base, 2–3.9cm long; sheaths overlapping, 4–5mm long; rachis weakly zigzag, 3–4cm long; floral bracts ovate, acute, membranous, 4–6 × 2–3mm. *Flowers* 4–5cm across, pure rich golden-yellow, lip usually with two oval purple-red blotches on the disc with red striations extending to base, column with 2 red-pink stripes; pedicel and ovary glabrous, narrow, 1.5cm long. *Sepals* subsimilar, elliptic-oblong, subacute, 7-veined, 2.5–4 × 0.8–1.2cm; *lateral sepals* adnate at base to form a mentum; *mentum* broad, 5–6mm long. *Petals* ovate, obtuse, margins entire to weakly undulate, 7-veined, 2.2–3 × 1.2–1.8cm. *Lip* simple, orbicular, base shortly clawed and wedge-shaped, margin deeply fimbriate, 2–3 × 2–3cm (when spread). *Column* broad, 8–9mm long. *Fruit* ovoid, 6–7 × 1.5–2cm.

Bhutan: S – Deothang district (Narfong (M.F.B.)); C – Tongsa (Shemgang), Tashigang (8km from Shali (M.F.B.), Tashi Yangtsi) and Tashigang/Sakden (between Gamri Chu and Sakden) districts; **Darjeeling** (Great Rangit River, Surail, Takdah); **Sikkim** (unlocalised *Hooker*, *King* and *Pantling* specimens). On oak and other trees and rocks; 330–2330m. Fl. July–October; Fr. October.

GENERAL DISTRIBUTION. ?Nepal, NE India and Myanmar.
ETYMOLOGY. Named after Joseph Dalton Hooker (1817–1911) who collected the type specimen.
NOTE. Phukan (1998) reported a peloric form of *D. hookerianum* from the E Khasia Hills in NE India.

18. **D. moschatum** (Buchanan-Hamilton) Sw. in Schrader, Neu. J. Bot. 1: 94 (1806). Type: Burma (Myanmar), Rangoon, *Buchanan-Hamilton* s.n. (holo. BM!).
Epidendrum moschatum Buchanan-Hamilton in Symes, Emb. Kingdom Ava: t.26 (1800); ed.2(3): 315 (1800).
Cymbidium moschatum (Buchanan-Hamilton) Willdenow, Sp. Pl. ed.4(1): 98 (1805).
Dendrobium calceolaria Carey ex Hook., Exot. Fl. 3: t. 184 (1826). Type without provenance, cult. Shepherd (holo. K-LINDL!).
D. cupreum Herbert in Bot. Reg. 21: t.1779 (1835). Type without provenance.
Callista moschata (Buchanan-Hamilton) Kuntze, Revis. Gen. Pl. 2: 653 (1891).

Plant epiphytic, 50–150cm tall; *roots* branched, fasciculate, woody. *Stems* clustered, stout, terete, erect to pendent, ridged, jointed; internodes sheathed, 2.5–3.5 × 0.4–0.7cm. *Leaves* lanceolate to elliptic-lanceolate, acute, subsessile, many-veined, distichous, jointed, 7–15 × 1.2–4.2cm. *Inflorescences* lateral, arising from nodes of leafy or leafless stem, laxly 8- to 16-flowered; peduncle sheathed at base, glabrous, 5–6.5cm long; sheaths 3–5, tubular, ovate, subacute, many-veined, 1–1.8cm long; rachis weakly zigzag, glabrous, 5.5–11cm long; floral bracts persistent, oblong-lanceolate, acute, 1.4–2 × 0.3–0.5cm. *Flowers* showy, fragrant, 6–8cm across, colour variable, sepals and petals yellow-ochre, yellow, apricot to white with reddish tips and red-orange veins, lip yellow-ochre, yellow to white with 2 brown-purple or red spots inside, column yellow, anther purple; pedicel and ovary glabrous, 3.2–4cm long. *Sepals* subequal, ovate-lanceolate to lanceolate, acute to subacute, 2.6–4.5 × 0.8–2cm; *lateral sepals* adnate at base to form a mentum; *mentum* broad, gibbous, 5–9mm long. *Petals* ovate-lanceolate to broadly ovate, subacute to obtuse, 7-veined, 2.8–4.4 × 1–2.3cm. *Lip* simple, slipper-shaped (margins incurved), globose to pyriform, margins entire, pilose, 2–2.5 × 1.5–2.6cm. *Column* broad, with a foot, 4–7mm long. *Fruit* ovoid-pyriform, crenately ridged, 3–3.8 × 1–1.2cm.

Bhutan: S – Phuntsholing (Phuntsholing) and Chukka (Marichong) districts; **Darjeeling** (Great Rangit River); **Sikkim** (unlocalised *Pantling* specimens). In tropical valleys: 500–1000m. Fl. July–August.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, Thailand, Laos and Vietnam.

ETYMOLOGY. From the Greek *moschatus* (musk) and the Latin adj. suffix *-atus* (indicating a likeness) in reference to the scent of the flowers.

19. **D. nobile** Lindl., Gen. Sp. Orchid. Pl.: 24 (1830). Type: China, icon. Reeves (holo. Royal Horticultural Society! no.30, iso. BM! no. 890).

Dendrobium coerulescens Wall. in Lindl., Sert. Orchid. 3: t.18 (1838). Type: India, Khasia, Nungklow, *Gibson* s.n., cult. (holo. K-LINDL!).

D. lindleyanum Griff., Not. Pl. Asiat. 3: 309 (1851); Icon. Pl. Asiat. 3: t.308 (1851). Type: India, Suddhya, *Griffith* (holo. not found).

D. nobile var. *formosanum* Rchb. f. in Gard. Chron. n.s. 19: 432 (1883). Type from Taiwan.

Callista nobilis (Lindl.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).

Dendrobium formosanum (Rchb. f.) Masamune in Trop. Hort. 3: 32 (1933).

D. friedericksianum sensu Brix in Bull. Soc. Roy. Sci. Nat. Laos 5: 8 (1962), *non* Rchb. f.

Plant epiphytic or lithophytic, forming large clumps; *roots* clustered, woody, c.2mm wide. *Stems* clustered, compressed, swollen at base, covered with sheaths, beaded, wavy to weakly zigzag, becoming grooved with age, jointed, yellowish, 30–50cm long; internodes 2.5–3.5 × 0.5–1.2cm; sheaths tubular, 2–4.5cm long. *Leaves* oblong to spathulate, emarginate, many-veined, sessile, coriaceous, distichous, persistent, 7–13.5 × 1–3cm. *Inflorescences* lateral, arising from nodes, 2- to 4-flowered; peduncle attenuated, bracteate at base, 1-flowered from each node, 0.6–1.5cm long; peduncle bract ovate, membranous, 0.7–1.1cm long; floral bracts oblong-ovate, obtuse, scarious, tubular, 7–8mm long. *Flowers* variable, waxy, fragrant, 6–8cm across; sepals and petals white at base grading to pinkish-mauve above, lip rich maroon at base grading to yellow or white with mauve to purple margins; pedicel and ovary glabrous, 3–4.8cm long. *Sepals* oblong-lanceolate, subacute to obtuse, 7-veined, 3–4.5 × 0.8–1.6cm; *lateral sepals* united at base to form a mentum; *mentum* short, obtuse, 3–4mm long. *Petals* ovate-oblong, obtuse, margins weakly undulate, 7-veined, 3–4 × 1.6–2.5cm. *Lip* simple, shortly clawed, convolute at base, ovate-oblong in outline, pubescent above and below, margins entire, 3–4.5 × 2–3cm. *Column* with acute stelidia, 7–9mm long; anther cap serrulate in front. *Fruit* c.6 × 1.2cm. **Plate 23.**

Bhutan: S – Chukka (Raidak Valley), Sarbhang (Kami Khola) and Gaylegphug (Nabzi) districts; C – Punakha (Bhotokha to Rimchu, near Khosa, between Wache and Ngawang, between Yuwak and Wangdi Phodrang), Mongar (between Kuru Chu and Lingitsi) and Tashigang (Shali (M.F.B.), near Tashi Yangtsi) districts; **Darjeeling** (Punkhabari); **Sikkim** (Pemayangtse, between Lower Rangpo Chhu and Pakhyong, Temi, Tumlang). On oak trees in warm dense broad-leaved forest, on rocks in river valleys, on citrus in plantation; 330–2000m. Fl. March–May(–June).

GENERAL DISTRIBUTION. Nepal, India, Myanmar, China and Thailand.

ETYMOLOGY. From the Latin *nobilis* (grand, noble) in reference to the flowers.

20. D. ruckeri Lindl. in Bot. Reg. 29: t.60, misc.25, no.38 (1843). Type: the Philippines, Cuming, cult. Rucker (holo. K-LINDL!).
Dendrobium ramosum sensu Lindl., Gen. Sp. Orchid. Pl.: 82 (1830), *non* (Ruiz & Pavon) Persoon (1807).
Callista ramosa (Lindl.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).
C. ruckeri (Lindl.) Kuntze, loc. cit. (1891).

Plant epiphytic, pendent, 30–60cm long. *Stems* slender, branching from nodes; internodes covered by sheaths, yellowish, 1.5–4.8cm long. *Leaves* lanceolate, acute to acuminate, entire, sessile, distichous, 5–7.2 × 1.4–1.9cm. *Inflorescence* leaf-opposed, 1- or 2-flowered; peduncle short, sheathed at base, 0.9–1.3cm long; sheaths membranous, overlapping, 4–5mm long; floral bracts broadly lanceolate, 3-veined membranous, 4–5 × 2.5–3.5mm. *Flowers* fragrant, c.2cm across, pale primrose-yellow to cream, lip with numerous radiating streaks of brown-purple and yellow, disc on lip green; pedicel and ovary slender, 0.6–1cm long. *Sepals* subsimilar, 7-veined, 1.1–2.2 × 0.5–0.8cm; *dorsal sepal* elliptic, obtuse; *lateral sepals* broadly elliptic, weakly falcate, widening towards base; *mentum* broad, with a short bifid pouch, 3–4mm long. *Petals* oblong, subspathulate, obtuse, 0.9–1.1 × 0.3cm. *Lip* 3-lobed, deeply concave to hooded, obovate to rhombic (when spread), 1.3–1.6 × 1.2–1.8cm; lateral lobes large, broad, convolute; epichile suborbicular, bifid, deflexed, margins crisped; disc with an elongate, villous crest, extending from base to near apex. *Column* stout, 8–9mm (with foot).

Darjeeling (Nimbong); **Sikkim** (Naru? Valley). 1330–1660m. Fl. May.

GENERAL DISTRIBUTION. NE India and Myanmar.
ETYMOLOGY. Named after Sigismond Rucker who cultivated and flowered the type specimen.
NOTE. The name D. *ramosum* Lindl. cannot be applied to this species because of the earlier *D. ramosum* (Ruiz & Pavon) Persoon.

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21. D. transparens Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 79 (1830). Type: Nepal, coll. *Wallich* Wall. Cat. 2008.1 (holo. K-LINDL!, iso. E! K! K-W!).
Dendrobium henshallii Rchb. f. in Bonplandia 3: 226 (1855). Type without provenance.
Callista transparens (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).

Plant epiphytic, 25–60cm tall. *Stems* slender, erect, swollen at nodes, pseudobulbous at base; internodes covered by leaf sheaths, yellowing with age, 2.5–5cm; sheaths tubular, funnel shaped, fibrous when old. *Leaves* linear-lanceolate to oblong-elliptic, acute to oblique, sessile, jointed, many-veined, 5.5–11.5 × 1.1–1.6cm. *Inflorescence* lateral, arising from leafless stem, 2-flowered; peduncle attenuate; floral bracts broadly lanceolate, scarious, 7–8 × 4–5mm. *Flowers* 3–5cm across; petals and sepals white suffused with pink, lip with a large purple patch at base, column greenish-yellow; pedicel and ovary slender, 2–2.5cm long. *Sepals* subequal, lanceolate, acute, 5-veined; dorsal sepal 2.7–2.9 × 0.4–0.5cm; *lateral sepals* 2.1–2.5 × 0.4–0.6cm; mentum conical, obtuse, 5 × 4mm. *Petals* ovate, acute, 1.8–2.7 × 0.7–0.8cm. *Lip* clawed, broadly elliptic-obovate to sagittate (when spread), obscurely 3-lobed, 1.8–2.6 × 1.2–1.4cm; lateral lobes broad, erose, rolled over the column; mid-lobe suborbicular, margins undulate, pubescent on upper surface. *Column* with 2 horn-like stelidia at apex, 6–8mm long (with foot). *Fruit* stalked, ovoid, 1.5–2.8 × 0.4–1.5cm. **Plate 23.**

Bhutan: S – Phuntsholing (Phuntsholing) and Gaylegphug (Gaylegphug) districts; **Darjeeling** (unlocalised *Griffith* specimen); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). On *Shorea robusta*, in dense wet forest; 500–1500m. Fl. April–May.

GENERAL DISTRIBUTION. India, Nepal and Myanmar.
ETYMOLOGY. From the Latin *transparens* (transparent), probably referring to the thin-textured flowers.

Section **Breviflores** Hook. f., Fl. Brit. India 5(2): 711 (1890).

22. **D. aduncum** Wall. ex Lindl. in Bot. Reg. 28: misc.58, no.62 (1842). Type: NE India, cult. Loddiges s.n. (holo. AMES!).

Callista adunca (Wall. ex. Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Dendrobium faulhaberianum Schltr. in Orchis 5: 58, t.5 (1911). Type unlocalised, cult.

D. aduncum var. *faulhaberianum* (Schltr.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 80 (1951).

Plant epiphytic, pendent, 30–50cm long. *Stems* branching, narrow, grooved, yellowish, 2–4mm wide; internodes sheathed, 1.5–4.2cm long. *Leaves* oblong-lanceolate, acute to acuminate, minutely to obliquely emarginate, sessile, 5–9.2 × 0.6–1.5cm. *Inflorescence* lateral, from leafless stem, 3- or 4-flowered; peduncle short, sheathed at base, glabrous, 8–9mm long; sheaths overlapping, membranous, 3–5mm long; rachis slender, zigzag, glabrous, 1.5–3cm long; floral bracts sheathing or free, elliptic-ovate, obtuse, 3–6 × 1–1.5mm. *Flowers* 1.5–2cm across, uniformly pale purple, anther dark purple; pedicel and ovary slender, 1–1.1cm long. *Dorsal sepal* ovate, acute to acuminate, 5-veined, 0.9–1 × 0.2–0.4cm; *lateral sepals* triangular to sub-rhombic, 5-veined, adnate at base to form a mentum, 0.9–1.1 × 0.3–0.5cm; *mentum* broad, 3–4mm wide. *Petals* ovate, acute to acuminate, 7–9 × 2–4mm. *Lip* simple, shortly clawed, broadly elliptic (in outline), apex abruptly acuminate, margins entire, surface pubescent, 8–9 × 5–6.5mm. *Column* with beaked, rounded appendages apically, c.2mm long. *Fruit* ovoid, 1–1.5 × 0.4–0.6cm. **Plate 19.**

Bhutan: S – Sarbhang district (10km W of Sarbhang, Singi Khola); **Darjeeling** (Ramthi Valley); **Sikkim** (unlocalised *Pantling* specimen). Subtropical terai forest on river bank; 390–660m. Fl. March–August.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand and Vietnam.

ETYMOLOGY. From the Latin *aduncus* (hooked, curved) in reference to the wings at the column apex.

23. **D. bicameratum** Lindl. in Bot. Reg. 25: misc.59, no.85 (1839). Type: N India, icon. Gibson (holo. K-LINDL!).

Dendrobium bolboflorum Falconer ex Hook. f., Fl. Brit. India 5(2): 729; Icon. Pl. t.2028 (1890).

Types: India, Darjeeling, *Gamble* 10510 (syn. K!); Indian, Sikkim, *Clarke* 12268 (syn. K!).

Callista bicamerata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

C. bolboflora (Falconer ex Hook. f.) Kuntze, *loc. cit.* (1891).

Plant epiphytic, 14–40cm tall. *Stems* fusiform to clavate, curved or wavy, ridged, sheathed, yellowish, bearing leaves towards apex, 14–40 × 0.4–0.8cm; internodes 2–4cm long; sheaths 1.8–3.6cm long. *Leaves* 2–6, elliptic-oblong to elliptic-lanceolate, acute, obliquely emarginate, veined, tapered and sheathing at base, jointed, 4–9.5 × 0.6–2.3cm. *Inflorescence* lateral, short, subcapitate, subdensely 4- to 6-flowered; peduncle short, sheathed, 5–7mm long; sheaths overlapping, broadly ovate, 1.5–3.5mm long; rachis glabrous, weakly zigzag, 3–8mm long; floral bracts sheathing pedicel, membranous, lanceolate, acute, 3–4 × 1.5–2mm. *Flowers* 7–8mm across, yellow, marked with red; pedicel and ovary glabrous, 3–6mm long. *Dorsal sepal* broadly ovate-oblong, acute, 5-veined, 6–7 × 3–3.5mm; *lateral sepals* broadly triangular, subacute, 5-veined, concave, adnate at base to form a mentum, 5–7.5 × 3–5mm; *mentum* urceolate. *Petals* broadly elliptic, obtuse, 5–5.5 × 2.3–2.5mm. *Lip* 3-lobed, fleshy, concave, broadly triangular in outline, base narrow, 3–4.5 × 4–4.5mm (across lateral lobes when spread); lateral lobes triangular, acute, erect; mid-lobe short, truncate, oval, apex acute; disc with cushion-shaped callus. *Column* 4–5mm (with foot); foot biloculate; anther cap c.1mm across. *Fruit* ovoid, c.1.4 × 0.8cm.

Bhutan (unlocalised *Strickland* specimen); **Darjeeling** (Great Rangit River, Kalimpong (Seidenfaden, 1985)); **Sikkim** (Rimbi Chhu). 660–2330m. Fl. July–August.

GENERAL DISTRIBUTION. India, Nepal and Myanmar.
ETYMOLOGY. From the Latin *bi-* (two) and *camera* (chamber, vault) in reference to the characteristic bilocular column foot.
NOTE. Seidenfaden (1985) reviewed the taxonomy of this species.

Section **Stuposa** Kränzlin in Engler, Pflanzenr. (IV.50) Dendrob.: 55 (1910).

Kränzlin separated this section from *Breviflores*, to include plants with a ciliate lip, a treatment followed by Pradhan (1979) and Brieger (1981). Seidenfaden (1985) rejected its use and included it in section *Breviflores*. Despite Seidenfaden's reservations, we feel that sectional treatment is both useful and valid.

24. D. praecinctum Rchb. f. in Gard. Chron. n.s. 7: 750 (1877). Type: Unlocalised, cult. Veitch (holo. W! Herb. no. 39641).
Dendrobium pauciflorum King & Pantling in J. Asiat. Soc. Bengal 64(3): 332 (1896). Type: India, Sikkim, Engo, *Pantling* 172 (holo. CAL).
Callista praecincta (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).
Dendrobium sikkimense A.D. Hawkes & Heller in Lloydia 20(2); 124 (1957), *nom. superfl.*

Plant epiphytic, pendent; *roots* clustered at nodes. *Stem* long, pendent, sheathless, narrow, terete, branching from nodes, 2–3mm thick, bearing leaves at apex; internodes 1.4–3.7cm long. *Leaves* 4, linear-lanceolate, obliquely emarginate, sessile, 3–6.5 × 0.8–1cm; sheaths shortly attenuate. *Inflorescence* axillary from leafless stem, 1- to 4-flowered; peduncle slender, sheathed at base; floral bracts ovate, obtuse, small, c.2mm long. *Flowers* c.1.9cm long, yellow to pale yellow-white, sepals and petals edged with purple, lip mid-lobe spotted red; pedicel and ovary short, 5–8mm long. *Dorsal sepal* lanceolate-ovate, obtuse, 0.3–1cm long; *lateral sepals* ovate, weakly falcate, keeled, 0.4–1 × 0.2–0.4mm. *Petals* lanceolate-ovate, ciliolate, 0.4–1cm long. *Lip* 3-lobed, clawed, 0.4–1.2 × 0.3–0.8cm; lateral lobes narrow, porrect, margins hispid-fimbriate; mid-lobe oblong, flat, margins hispid-fimbriate; disc thickened, with 3 lines. *Column* broad, with a foot, 2–7mm long. **Plate 23.**

Bhutan: S – Deothang district (Narfong (M.F.B.)); **Sikkim** (Nango, Simvo). In warm evergreen broad-leaved forest; 1000–1330(–1850)m. Fl. June–July.

GENERAL DISTRIBUTION. NE India and east to Thailand.
ETYMOLOGY. From the Latin *praecinctus* (wrapping around, girding), probably in reference to the hairs that gird the lateral lobes of the lip.
NOTE. Seidenfaden (1995) treated D. *pauciflorum* as conspecific with this species.

25. D. stuposum Lindl. in Bot. Reg. 24: misc.52, no.94 (1838). Type: India, cult. Loddiges s.n. (holo. K-LINDL!).
Dendrobium sphegidoglossum sensu Hook. f., Fl. Brit. India 5(2): 737 p.p.(1890), non Rchb. f.
Callista stuposa (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, 13–29cm tall; *roots* fasciculate. *Stems* caespitose, unbranched (occasionally branched), subclavate, grooved, yellow, sheathless; internodes 2.5–4.5cm long. *Leaves* oblong, obtuse-emarginate, distichous, sessile, 4.5–8 × 0.6–1.2cm; sheaths short. *Inflorescences* lateral, arising from nodes, leaf-opposed or from leafless stem, 2- or 3-flowered; peduncle slender, glabrous, sheathed; sheaths distant, broadly ovate, obtuse, enlarging up peduncle, 2–6 × 1.5–3.5mm; floral bracts linear-oblong, obtuse, strongly 7-veined, 4–7 × 1.5–2mm. *Flowers* 1–1.4cm long, pure white, lip with a blotch of dull yellow-orange at apex, mentum suffused with green; pedicel and ovary slender, subclavate, 0.9–1cm long. *Dorsal sepal* ovate, acute, 5-veined, 0.8–1.2 × 0.2–0.45cm; *lateral sepals* ovate, acuminate-aristate, 5-veined, adnate at base to form a mentum, 1.4–1.5 × 0.4–0.45cm; *mentum* broadly conical, c.3mm wide. *Petals* oblong-obovate, shortly clawed, obtuse, margins erose-ciliate, 1–1.2 × 0.4–0.45cm.

Lip 3-lobed, 0.9–1.4 × 0.55–0.8cm (across lateral lobes when spread): lateral lobes long, narrow, triangular, acute to weakly truncate, apical margins ciliate; mid-lobe ovate-orbicular, apical surface densely glandular-hairy, margins long-ciliate; disc unadorned. *Column* broad, 6–7mm long (with foot). *Fruit* clavate, 1.6–2.5 × 0.3–0.4cm.

Bhutan: C – Tashigang district (near Tashi Yangtsi (M.F.B.)); **Sikkim** (unlocalised Pantling specimens). In tropical valleys; 2000m. Fl. June.

GENERAL DISTRIBUTION. NE India, Myanmar, China and Thailand.
ETYMOLOGY. From the Latin *stupeus* (a tuft or mass of hair or filaments) in reference to the tow-like hairiness on the apex of the lip.

Section **Formosae** (Bentham & Hook. f.) Hook. f., Fl. Brit. India 5(2): 710 (1890).

(Subsect. *Nigrohirsuta* Lindl. in J. Proc. Linn. Soc., Bot. 3: 16 (1859), treated as a section by Brieger (1981); sect. *Oxygenanthe* Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 448 (1912). Seidenfaden (1985) discussed the sectional status of this group and we follow his treatment here).

26. **D. formosum** Roxb. ex Lindl. in Wall., Pl. Asiat. Rar. 1: t.29 (1830). Type: Bangladesh, Sylhet, M.R. Smith s.n. (holo. BM!).
Dendrobium formosum Roxb., Hort. Bengal.: 63 (1814), *nom. nud.*
D. infundibulum sensu Rchb. f. in Gartenflora 36: t.1253 (1887), *non* Lindl.
Callista formosa (Roxb. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant large, epiphytic, pendent. *Stems* terete, thick, woody, sheathed, slightly swollen (pseudobulbous) at base; internodes black-pilose, 2–2.9 × 0.5–0.9cm; sheaths black-pilose, appressed. *Leaves* oblong, obliquely subacute, emarginate, sessile, distichous, 4.5–17.4 × 1.5–3.4cm. *Inflorescences* terminal or lateral, 3- to 5-flowered; peduncle sheathed, 4.3–4.5cm long; sheaths funnel shaped, prominently veined, 0.3–1.1cm long (enlarging up peduncle); floral bracts ovate, obtuse, 1.1–1.2 × 0.2–0.4cm. *Flowers* fragrant, 5–9cm across, white, lip with large central yellow patch; pedicel and ovary 3.5–5cm long. *Dorsal sepal* lanceolate, acute to acuminate, finely reticulate, 4.2–5.8 × 1.2–1.7cm; *lateral sepals* oblong-lanceolate, subacute, adnate at base, 4.5–6.4 × 1.2–1.9cm; *mentum* conical, 0.8–1cm long. *Petals* suborbicular, cuspidate, finely reticulate, margins undulate, 4.8–6.8 × 3.3–4.8cm. *Lip* 3-lobed, obcuneate to broadly obovate (when spread), shortly clawed at base, 5.5–7.6 × 3.5–5cm (across lateral lobes); lateral lobes small subtriangular; mid-lobe obscurely 2-lobed, emarginate to minutely mucronate, surface tuberculate especially along veins, margins undulate; disc 2-lamellate, tuberculate-papillose centrally. *Column* broad, 1.3–1.9 × 0.6–1.1cm; foot short, 0.9–1.1 × 0.45–0.6cm. *Fruit* broadly ovoid, 2.5–3 × 1.6–2cm.

Sikkim (unlocalised *Pantling* specimen). On sal (*Shorea robusta*) trees; 330m. Fl. May.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand and ?Vietnam.
ETYMOLOGY. From the Latin *formosus* (beautiful) in reference to the large flowers.
NOTE. This is the largest-flowered species of *Dendrobium* in the region.

27. **D. longicornu** Lindl., Gen. Sp. Orchid. Pl.: 80 (1830). Types: Nepal, Thoka, coll. *Wallich* Wall. Cat. 1997.1 (syn. K-LINDL!, isosyn. K! K-W!); Bangladesh, Sylhet, coll. *F. De Silva* Wall. Cat. 1997.2 (syn. K-LINDL!, isosyn. K! K-W!).
Dendrobium flexuosum Griff., Not. Pl. Asiat. 3: 317 (1851). Type: India, Khasia, *Griffith* s.n. (holo. K-LINDL!).
D. hirsutum Griff., Not. Pl. Asiat. 3: 318 (1851); Icon. Pl. Asiat. 3: t.305 (1851). Type: India, Khasia, *Griffith* s.n. (holo. K-LINDL!).

D. longicornu var. *hirsuta* (Griff.) Hook. f., Fl. Brit. India 5(2): 720 (1890).
Callista longicornis (Lindl.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).
Dendrobium bulleyi Rolfe in Notes Roy. Bot. Gard. Edinburgh 8: 20 (1913). Type: China, Yunnan, *Forrest* 1091 (holo. E!).

Plant epiphytic, erect, 10–40cm tall; *roots* fasciculate. *Stems* erect, zigzag to weakly zigzag, sheathed, 2–4mm thick; internodes yellow, 2.5–4cm long; sheaths tubular, funnel shaped, black-hairy, 2.5–4cm long. *Leaves* distichous, ovate-elliptic to oblong-lanceolate, subacute, emarginate, puberulous, sessile, 2.5–8 × 1–2.2cm. *Inflorescence* axillary, arising from near apex of stem, usually 1-flowered; peduncle attenuate, sheathed; sheaths short, overlapping, scarious, 2–3 × 1.5–2mm; floral bract lanceolate, subacute, black-hairy, 8 × 3mm. *Flower* fragrant, 3–4.5cm across; sepals and petals white, lip white to pale brownish-white, veined with yellow or red-orange, flushed with yellow; pedicel and ovary slender, 2.2–3.5cm. *Sepals* subsimilar, ovate-lanceolate, acuminate, keeled; *dorsal sepal* 5-veined, 1.7–2 × 0.5–0.7cm; *lateral sepals* adnate to form a long, spur-like mentum, 5- to 7-veined, 2.5–3 × 0.6–0.7cm (towards base); *mentum* slender, attenuate, 1.5–2cm long. *Petals* ovate to ovate-lanceolate, acute to acuminate, keeled, 3-veined, 1.5–2.2 × 0.4–0.7cm. *Lip* 3-lobed, broadly triangular (when spread), 2.2–3 × 2.4–2.9cm; lateral lobes rounded, margins entire to weakly undulate, 2.2–2.5 × 1–1.1cm; mid-lobe small, suborbicular, fimbriate-lacerate, 6–9mm wide; disc with a broad central ridge from base to mid-lobe where it divides into 3 or 4 branches. *Column* with 2 stelidia at apex, 5–8mm long; foot 1–1.2cm long. **Plate 22.**

Bhutan: S – Chukka district (Raidak Valley); C – Thimphu/Punakha (Henle La), Punakha (Khelekha, Talo, Tinlegang, Wangdi Phodrang), Tongsa (Dakpai (M.F.B.), Shemgang, Tashiling, Tongsa, Tongsa Bridge) and Tashigang (Jiri Chu, Tashi Yangtsi, Yongpu La) districts; **Darjeeling** (Dumsong, Kurseong, Mongpu, Sureil); **Sikkim** (Bakhim, Chungthang, Neebay?, between Yoksam and Chhokha). On *Quercus* sp., in mossy evergreen oak forest; 1330–3000m. Fl. August–December.

GENERAL DISTRIBUTION. India (Himalayas), Nepal and Myanmar.
ETYMOLOGY. From the Latin *longus* (long) and *cornu* (horn) in reference to the mentum.
NOTES. *D. longicornu* is closely related to *D. wattii* (Hook. f.) Rchb. f. and *D. infundibulum* Lindl. Reichenbach (in the original description) and Seidenfaden (1985) discussed the possibility that *D. wattii* might be a hybrid between *D. longicornu* and *D. infundibulum*. Schelpe (in Seidenfaden, 1985) considered *D. wattii* to be conspecific with *D. infundibulum* and we incline to this view. These species, along with *D. cariniferum* Rchb. f., are closely allied and further field-work is required in order to resolve the taxonomy.

Section **Stachyobium** Lindl. in Bot. Reg. 30: 46 (1844).

Brieger (1981) gave subgeneric status to *Stachyobium*; we prefer to follow Seidenfaden (1985) in retaining Lindley's original sectional rank.

28. D. darjeelingense Pradhan, Indian Orch.: Guide Identif. & Cult. 2: 336 (1979). Type: India, Darjeeling, U.C. *Pradhan's collector* s.n. (holo. Herb. Pradhan).

Plant epiphytic, small; *roots* numerous, slender. *Stems* erect, c.7.5cm long. *Leaves* 3–5, oblong, obtuse to acute, emarginate, deciduous, pale green, c.4 × 1cm. *Inflorescence* erect, c.4cm long, 4- to 6-flowered; peduncle sheathed, 1–1.5cm long; sheaths few; floral bracts 1–2mm long. *Flowers* pale green; pedicel and ovary c.4cm long. *Dorsal sepal* oblong-ovate, subacute, 3-veined, c.6 × 2mm; *lateral sepals* lanceolate, acute, obliquely curved, 5-veined, c.6 × 4mm; *mentum* c.5mm long. *Petals* oblong-lanceolate, acute. 3-veined, c.5.5 × 1.5mm. *Lip* 3-lobed, c.6 × 4mm; lateral lobes expanded, acute, margins entire; mid-lobe transversely quadrate, margins undulate, incurved; disc 3-keeled from base to apex. Column c.2.5mm long; foot 2.5–3mm long.

Darjeeling (Pradhan, 1979). Fl. October.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From Darjeeling, where the type specimen was collected.
NOTES. This species is related to *D. eriaefolium* but has erect scapes, smaller flowers, a lip which lacks serrations on the lateral lobes and a 3-keeled disc. We have seen no material of this species and the description is taken from the protologue.

29. **D. denudans** D. Don, Prodr. Fl. Nepal.: 34 (1825). Type: Nepal, Gossainthan, *Wallich* s.n. (holo. BM!).
Callista denudans (D. Don) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, pendent, 14–30cm long; *roots* slender. *Stems* suberect, terete, covered by leaf sheaths; sheaths tubular, ovate, 2–2.5cm long. *Leaves* oblong to linear-oblong, acute to subacute, obliquely emarginate, sessile, jointed, 3.5–7.5 × 0.3–1.5cm. *Inflorescences* leaf-opposed, axillary, 10- to many-flowered; peduncle slender, sheathed, glabrous, 2–4.5cm long; sheaths linear-lanceolate, acute, membranous, 5–6 × 0.5–1mm; rachis glabrous, 3–10cm long; floral bracts lanceolate, acute, membranous, 3–4 × 0.5–1mm. *Flowers* lunate in bud, 1–2cm across; sepals and petals pale green to white, lip with radiating red-purple lines, mentum purple, column foot red; pedicel and ovary slender, glabrous, 6–8mm long. *Sepals* subsimilar; *dorsal sepal* linear-lanceolate, acuminate, 3- to 5-veined, 1.2–2 × 0.12–0.15cm; *lateral sepals* lanceolate-triangular, acuminate, falcate, 5-veined, 1.2–2.1 × 0.2–0.4cm (at base); *mentum* broadly conical, 2–3mm long. *Petals* linear-oblong, acute to acuminate, 3-veined, 0.8–1.3 × 0.1–0.12cm. *Lip* 3-lobed, decurved at base, 5–7 × 3.5–4mm (when spread); lateral lobes long, narrow, margins serrate-lacerate; mid-lobe recurved, obdeltoid to obovate, margins serrate-crisped, 1.5–2mm long; disc with an obscurely 3-ridged from base to centre of mid-lobe. *Column* 3mm long; foot angled to column, curved, hispid, 6mm long; anther cap margins denticulate. **Plate 21.**

Bhutan: C – Tongsa district (above Tama); **Darjeeling** (Kalimpong, Rishep); **Sikkim** (Chongpung, Chunthang, Linchyum, Lusing, Rimbi Chhu, Sosing). In *Quercus griffithii* and *Q. glauca* forest; 830–1830m. Fl. September–October.

GENERAL DISTRIBUTION. NW India, Nepal and NE India.
ETYMOLOGY. From the Latin *denudans* (stripped) in reference to the stems which lose their leaves early.

30. **D. eriiflorum** Griff., Not. Pl. Asiat. 3: 316 (1851); Icon. Pl. Asiat. 3: 307 (1851). Type: India, Khasia Hills, *Griffith* 230 (holo. K-LINDL!, iso. K!).
Callista eriiflora (Griff.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic or lithophytic, 7–23cm tall; *roots* slender. *Stems* erect, clustered, expanded and ± pseudobulbous at base, yellowish, covered by leaf sheaths, bearing flowers and leaves at the same time; internodes 2–2.5cm long; sheaths brown-membranous, broadly ovate, many-veined, loose, 1.2–2cm long. *Leaves* oblong-elliptic to linear-lanceolate, obliquely emarginate, subsessile, jointed, 2.3–6.1 × 0.5–1.1cm. *Inflorescences* lateral and terminal, pendent, 7- to 10-flowered; peduncle slender, glabrous, sheathed, 2–3.5cm long; sheaths 2, membranous, lanceolate, acute, 5–6 × 1–1.5mm; rachis glabrous, 1.8–5.2cm long; floral bracts ovate-lanceolate, acuminate, membranous, 3–4 × 1–1.5mm. *Flowers* lunate or boat-shaped in bud, 0.8–2cm across; sepals, petals and lip greenish-cream, lip and column spotted, flushed or striped with purple; pedicel and ovary slender, glabrous, 5–7mm long. *Sepals* subsimilar, 3-veined; dorsal sepal lanceolate, acuminate, 0.6–1.1 × 0.15–0.2cm; *lateral sepals* lanceolate, falcate, acuminate, broadly based, adnate to form a mentum, 0.7–1.3 × 0.3–0.35cm; *mentum* broadly conical, 4–4.5 × 3–3.5mm (wide at base). *Petals* linear, acute, 3-veined, 0.6–1.1 × 0.1–0.15cm. *Lip* curved, sessile, 3-lobed, broadly oblong-ovate (when spread), 5–8 × 4.5–5mm; lateral lobes elongate, margins toothed-serrate; mid-lobe acute, recurved, margins undulate to weakly lacerate; disc with a central crest. *Column* held at right-angles to foot, 2–3.5mm long (without foot); foot 4–6.5mm long; margins of anther cap minutely toothed. **Plate 21.**

Bhutan: S – Phuntsholing district (above Rinchending); C – Punakha (Byaphu), Tongsa (Tongsa Dzong) and Tashigang (SE of Shali (M.F.B.)) districts; **Darjeeling** (unlocalised *Cowan* and *Gamble* specimens); **Sikkim** (Lukrap). In subtropical valleys, in *Schima wallichii* forest; 830–2000m. Fl. September–November.

GENERAL DISTRIBUTION. India (Himalayas), Nepal and Myanmar.
ETYMOLOGY. From the orchid genus *Eria* and the Latin *-florus* (flowered) in reference to the superficial resemblance of the flowers to an *Eria* species.

31. **D. peguanum** Lindl. in J. Linn. Soc., Bot. 3: 19 (1859). Types: Myanmar, (Burma), Pegu, *McLelland* s.n. (syn. K-LINDL!); 'Borneo', *Lobb* s.n. (syn. K-LINDL!).
Dendrobium pygmaeum sensu Lindl., Gen. Sp. Orchid. Pl.: 85 (1830), **non** J.E.Smith (1819).
Callista pygmaea (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).
D. fesselianum M. Wolff in Orchidee (Hamburg) 41(3): 97 (1990). Type from Thailand.

Plant epiphytic, 3–3.5cm tall. *Pseudobulbs* globose, becoming wrinkled with age, sheathed, bearing 2–4 terminal leaves, 5–8 × 5–6mm; sheaths membranous, veined, ovate, subacute, 5–6 × 5–6mm. *Leaves* linear-oblong, subacute, sessile, caducous, coriaceous, rugose, 5–6.5 × 0.3–0.4cm. *Inflorescences* usually 2, terminal to subterminal on leafless stem, 7- to 12-flowered; peduncle shortly attenuate, sheathed, 3–5mm long; sheaths membranous, overlapping, lanceolate, 3–5mm long; rachis ridged, glabrous, 1.3–2cm long; floral bracts lanceolate, acute to acuminate, membranous, 1-veined, 2–7 × 0.6–1.3mm. *Flowers* fragrant, 1–1.5cm across, white, lip pale brown, veined with dark brown to purple, anterior lobe purple; pedicel and ovary glabrous, 3–3.5mm long. *Dorsal sepal* oblong-lanceolate, acute, 3-veined, erect, 8–10 × 1.3–1.8mm; *lateral sepals* oblong-lanceolate, acute, falcate-decurved, 8–9 × 1.5–2mm; *mentum* spur-like, 4–5mm long. *Petals* oblanceolate, falcate, subacute, 1-veined, 5–6 × 1–1.6mm. *Lip* 3-lobed, obovate-deltoid (when spread), shortly clawed, decurved, 4–5.5 × 3–4.5mm; lateral lobes narrow, subacute, entire; mid-lobe broadly triangular, margins crisped-undulate; disc with a broad, fleshy ridge, emarginate towards apex. *Column* broad, 1–2mm long; foot long, straight; anther cap margins minutely toothed, c.0.6mm across.

Terai (unlocalised *Anderson* drawing); **Darjeeling** (Baghdogra); **Sikkim** (unlocalised *Pantling* specimens). On *Shorea robusta*; 330m. Fl. November–January.

GENERAL DISTRIBUTION. Nepal, NE India and Myanmar.
ETYMOLOGY. From Pegu, a region in southern Myanmar, where the type collection was found.
NOTES. In the original description Lindley cited a collection from Pegu by McLelland and a Lobb collection from Borneo. There is no doubt that these two collections are of the same species, however, no plants from the section *Stachyobium* have ever been collected in Borneo. We suspect that the origin of the Lobb collection might have been incorrect. This was possibly deliberate and due to rivalry between collectors and their sponsoring nurseries; such deception is known to have occurred in the nineteenth century.

32. **D. porphyrochilum** Lindl. in J. Proc. Linn. Soc., Bot. 3: 18 (1858). Types: India, Khasia, *Hooker & Thomson* 28 (syn. K-LINDL!); Khasia, *Lobb* s.n. (syn. K-LINDL!); Assam, *Griffith* s.n. (syn. K-LINDL!).
Callista porphyrochila (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).
Dendrobium caespitosum King & Pantling in J. Asiat. Soc. Bengal 64(3): 332 (1896). Type: India, Sikkim, Naru Valley, *Pantling* 320 (holo. K!).

Plant epiphytic, 4–10cm tall; roots caespitose. *Stems* attenuate, pseudobulbous; pseudobulbs cylindric-conical, slender, yellowish, covered by overlapping sheaths, 0.5–1.8 × 0.3–0.4cm; leaf sheath membranous, veined, 0.9–1.1 × 0.5–0.7cm. *Leaves* 3 or 4, linear-oblong, obtuse to obliquely emarginate, sessile, jointed, 3–7 × 0.6–0.8cm. *Inflorescence* terminal from pseudobulb, solitary, pendent, 6- to 10-flowered; peduncle slender, sheathed at base glabrous, 2–3cm long; basal sheath 1, lanceolate, acute, membranous, c.3mm long; rachis weakly zigzag, glabrous, 3.5–5cm long; floral bracts linear-lanceolate, acuminate, 1-veined, 3–5 × 1–1.5mm. *Flowers* 1–1.5cm across; sepals and petals pale green-yellow with red veins, lip purple to brownish-purple edged with yellow or green; pedicel and ovary slender, glabrous, 5–7mm long. *Dorsal sepal* spreading, lanceolate, acute, 3-veined, 6–8 × 1–1.7mm; *lateral sepals* spreading, linear-lanceolate, acute, 3-veined, widened and adnate at base, 0.8–10 × 1–1.2mm; *mentum* short, obliquely rounded, obtusely angled. *Petals* oblong-lanceolate, acute, 5–6 × 1–1.2mm. *Lip* simple, elliptic-sagittate, subacute, decurved from base, flat, margins entire, weakly undulate, surface glandular-papillose at base, 3–4 × 1.2–1.8mm; disc 2-keeled from base to apex, thickened centrally, glandular-papillose. *Column* broad, 1–2mm long; foot concave.

Darjeeling (Ghoom to Kurseong, Takdah); **Sikkim** (Dentam to Pemayangtse, 5km NW of Gangtok, Lachen Valley, Naru? Valley). On trees in forest grazed by cattle; 1850–2330m. Fl. May–July.

GENERAL DISTRIBUTION. NW and NE India, Nepal, Myanmar, China and Thailand.
ETYMOLOGY. From the Greek *porphyro-* (purple) and *cheilos* (lip).

Section **Calcarifera** J.J. Smith in Bull. Dép. Agric. Indes Néerl. 15: 14 (1908).

The *Dendrobium cumulatum* group has been included within section *Pedilonum* (Bl.) Lindl. by most recent authors, but Dauncey (1994) reinstated section *Calcarifera* for this group and we follow this treatment here.

33. **D. cumulatum** Lindl. in Gard. Chron. 1855: 756 (1855). Type: Origin unknown (holo. K-LINDL!).
Callista cumulata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).
Dendrobium eoum Ridley in J. Linn. Soc., Bot. 32: 261 (1896). Type from Thailand.
Pedilonum eoum (Ridley) Rauschert in Feddes Repert. 94: 459 (1983).

Plant epiphytic, 30–60cm tall. *Stems* erect, thickened upwards, internodes covered by leaf sheaths; internodes yellowish, 2.5–4cm long; sheaths overlapping, 1.5–2.5cm long. *Leaves* oblong-lanceolate to elliptic, acute, distichous, sessile, sheathed, 5–9.5 × 1.5–3.6cm. *Inflorescence* corymbiform, borne on a leafless stem, 5- to 7-flowered; peduncle short, sheathed at base, 0.6–1.5cm long; sheaths overlapping, 4.5–5 × 2.5–3.5mm; rachis glabrous, zigzag, 1–1.8cm long; floral bracts lanceolate, acute, 2.5–3.5 × 1–1.5mm. *Flowers* fragrant, 3.5–4cm long, pink to pale purple or white, transparent, lip white with or without a pink patch at apex, yellowish at base; pedicel and ovary slender, 1.5–2.2cm long. *Dorsal sepal* elliptic, subacute, 7-veined, 1.8 × 0.7cm; *lateral sepals* elliptic, subacute, weakly falcate, 5-veined, adnate at base to form a mentum, 1.8–3 × 0.6–0.7cm; *mentum* long-conical, spur-like, 1.2–1.6 × 0.2–0.4cm. *Petals* obovate, 5-veined, margins undulate, 1.5–2 × 0.9–1.1cm. *Lip* simple, obovate-spathulate (when spread), long-clawed at base, dentate-geniculate at insertion with mentum, apex broad, emarginate, margins erose, 1.6–3.2 × 0.7–1.1cm; disc unadorned. *Column* broad, clavate, winged at apex, 6–9mm long; wing margins erose; foot long; anther cap c.2.5mm wide.

Bhutan (unlocalised *Lister* specimen); **Darjeeling** (unlocalised *Mann* specimen); **Sikkim** (Tista Valley). In tropical valleys. Fl. June–July.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand, Laos, Cambodia, Vietnam and Borneo.
ETYMOLOGY. From the Latin *cumulatus* (heaped) in reference to the dense inflorescence.

Section **Aporum** (Bl.) Bl., Bijdr.: Clav. Gen. Orchid. (1825).

Brieger (1981) re-established Aporum as a genus with a broad circumscription, splitting the genus into seven sections. Seidenfaden (1985) preferred to retain the sectional status as more practical and we follow this treatment here.

34. **D. anceps** Sw. in Kongl. Vetensk. Acad. Nya. Handl. 21: 246 (1800). Type: India Orient., unlocalised, *Swartz's collector* s.n. (holo. UPS-THUNB! Herb. no. 21468).
Aporum anceps (Sw.) Lindl., Gen. Sp. Orchid. Pl.: 71 (1830).
Callista anceps (Sw.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, 16–30cm tall; *roots* fasciculate, slender. *Stem* compressed, covered by leaf sheaths, branched, 2–3mm wide at base, 0.8–1cm wide at apex; internodes 2–2.5cm long; leaf sheaths many-veined, broad. *Leaves* distichous, overlapping, equitant, fleshy, lanceolate, acute, sessile, jointed, base broad, 2.5–5 × 0.6–1cm. *Inflorescences* lateral, arising from nodes between leaf-sheaths, 1-flowered; peduncle attenuate, sheathed, 3.4mm long; floral bracts oblong, obtuse, c.1.5 × 0.5mm. *Flowers* boat-shaped, 0.9–1.2cm across, yellowish-green, with pink lines on lip and pinkish mentum; pedicel and ovary slender, 4–5mm long. *Dorsal sepal* elliptic, subacute, 5-veined, 4–5 × 2–2.5mm; *lateral sepals* elliptic, obtuse, falcate, adnate at base to form a mentum, 6–8 × 2–3mm; *mentum* obtuse, 6–7mm long. *Petals* broadly elliptic, obtuse, 2–3 × 1.2–2.5mm. *Lip* wedge-shaped to oblong, simple to obscurely 3-lobed, apex 2-lobed, margins entire, undulate-crisped at apex, 5–7 × 3–4mm (at apex). *Column* 1–1.5mm long; foot 6–7mm long. *Fruit* ovoid, 7–9 × 4–5mm.

Bhutan: S – Gaylegphug district (Gaylegphug (M.F.B.)); **Darjeeling** (Tista River); **Sikkim** (Great Rangit River). In tropical valleys; 270–350m. Fl. April–July.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, Thailand and Indo-China.
ETYMOLOGY. From the Latin *anceps* (two-edged).

35. **D. spatella** Rchb. f. in Hamburger Garten-Blumenzeitung 21: 298 (1865). Type: India, Assam, cult. Day (holo. W! Herb. no. 40401).
Dendrobium acinaciforme sensu Hook. f., Fl. Brit. India 5(2): 723 (1890), non Roxb. (1832).
Callista spatella (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).
Dendrobium acinaciforme var. *minus* T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 40, 80 (1951). Type: China, Guangxi, Ching 7582 (holo. PE).
D. banaense Gagnepain in Bull. Mus. Natl. Hist. Nat., sér.2(2): 232 (1930). Type from Vietnam.

Plant epiphytic, erect, 9–40cm tall; *roots* clustered, basal, branched. *Stem* erect, weakly fusiform, yellowing, covered by leaf sheaths, leaves absent (or rudimentary) in upper half, 9–30cm long; internodes widening towards apex, 1–1.5cm long. *Leaves* many, overlapping, distichous, equitant, curved, lanceolate, acute, sessile, 2–3.5 × 0.5–1cm; sheaths 1–1.4cm long. *Inflorescences* lateral, arising from nodes, 1-flowered; peduncle attenuate, c.1mm long; floral bracts lanceolate, subacute, c.2 × 1mm. *Flowers* 6–7mm across; sepals and petals yellow, lip white; pedicel and ovary curved, 5–6mm long. *Dorsal sepal* ovate-lanceolate, obtuse, 5-veined, 3–4 × 1–2mm; *lateral sepals* ovate-lanceolate, subacute, connate at base to form a mentum, 5-veined, 4–5 × 2–3mm; mentum curved, 4–5.5mm long. *Petals* ovate, obtuse, 3-veined, 3–4 × 1–1.5mm. *Lip* simple, shortly clawed at base, widening to quadrate or wedge-shaped apex, margins crenulate, 4–5 × 4–5mm (at apex). *Column* erect, recurved at apex, 1.5–2.0mm long; foot 2–2.5mm long. *Fruit* ovoid, stalked, 5–6 × 2–2.5mm.

Bhutan: C – Tongsa (Tingtinbi) and Mongar (Lingmethang) distrcits. On *Quercus griffithii*; 200–1200m. Fl. May–June.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand, Laos, Cambodia, Vietnam and Peninsular Malaysia.

ETYMOLOGY. From the Latin *spatha* (a broad blade) and the suffix *-ella* (small) in reference to the lip shape.

NOTES. Seidenfaden (1985) and Yakawa & Ohba (1999) reviewed the history and taxonomy of *D. acinaciforme* Roxb. and proposed a resolution of the taxonomic confusion. Rao & Deori (1980) reported *D. acinaciforme* Roxb. from Rupa and Kalaktang in the Kameng district of Arunachal Pradesh, but we have seen no material from our area.

36. **D. terminale** Parish & Rchb. f. in Trans. Linn. Soc. London 30: 149 (1874). Type: Myanmar (Burma), Moulmein, Parish 33 (holo. W! Herb. no. 40385, iso. K!).
Callista terminalis (Parish & Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

Plant epiphytic, 6–12cm tall; *roots* slender, fasciculate. *Stem* subclavate (expanding upwards), slender at base, covered with leaf sheaths; internodes 0.5–1cm long; sheaths overlapping, many-veined, 1–1.2cm long. *Leaves* distichous, fleshy, oblong-elliptic, subacute to acute, equitant, jointed, base broad, sessile, 1.5–2.3 × 0.3–0.7cm. *Inflorescence* terminal, 1- or 2-flowered; peduncle attenuate, sheathed; floral bracts lanceolate, obtuse, 2–2.5 × 1–1.5mm. *Flowers* 4–6mm across, white to very pale pink, mentum with pink veins, lip with a yellow line; pedicel and ovary slender, 4–6mm long. *Dorsal sepal* small, lanceolate-elliptic, subacute, 3-veined, 3–4 × 1–1.5mm; *lateral sepals* lanceolate-elliptic, subacute, falcate, 3-veined, adnate to form a mentum, 8–9 × 2–3mm; *mentum* broad, obtuse, curved, 0.9–1cm long. *Petals* elliptic, obtuse, 1-veined, 2.5–3 × 1–1.3mm. *Lip* simple, wedge-shaped to triangular (when spread), base narrow, deflexed at the middle, apical margin weakly undulate to minutely erose, obscurely 2-lobed, 7–8 × 4–5mm (at apex, when spread). *Column* 1–2mm long; foot curved, 0.9–1cm long. Fruit ovoid, stalked, 4–7 × 2.5–4mm.

Bhutan: S – Sarbhang district (Singi Khola); **Sikkim** (unlocalised *Pantling* specimen). In terai forest. Fl. and Fr. September–October.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Vietnam and Malaysia.

ETYMOLOGY. From the Latin *terminalis* (terminal) in reference to the inflorescence.

Section **Grastidium** (Bl.) Bl., Bijdr.: Clav. Gen. Orchid. (1925).

Hooker (1890) established the section *Virgatae* (a superfluous name for section *Crumentae* Pfitzer) which included *D. cathcartii* Hook.f. However, this concept included species now thought to belong to a variety of sections and is no longer considered useful. Pradhan (1979) retained section *Angustifolia* (Kränzlin in Engler, Pflanzenr. (IV.50) Dendrob.: 165 (1910)) for this species but this section also included species now placed in other sections. Brieger (1981) re-established the generic concept of *Grastidium*, a treatment supported by Clements & Jones (1997a). Seidenfaden (1985) retained its sectional status and until further evidence becomes available we follow this treatment here.

37. **D. cathcartii** Hook. f., Fl. Br. India 5(2): 727 (1890). Type: India, Sikkim Himalaya, icon. Cathcart (holo. K!).
Grastidium cathcartii (Hook. f.) M.A. Clements & D.L. Jones in Lasianthera 1(2): 67 (1997).

Plant epiphytic, 50–70cm tall. *Stems* erect, terete, uniform in size, many-leaved; internodes yellowish, sheathed, 2–2.6cm long; sheaths cylindric, rugose, 2–3cm long. *Leaves* linear-lanceolate, obliquely notched, sessile, distichous, jointed, 7–13 × 0.8–1.4cm. *Inflorescence* fasciculate, lateral, arising 4–6mm below a node, 2-flowered; peduncle attenuate, 3–4mm long; floral bracts short, lanceolate, c.2mm long. *Flowers* 1.2–1.6cm long; sepals and petals golden yellow, lip yellow marked with purple; pedicel and ovary slender, 1–1.5cm long. *Dorsal sepal* ovate-lanceolate, acute, 0.9–1 × 0.2–0.25cm; *lateral sepals* lanceolate, adnate at base to form a mentum, 0.9–1 × 0.2–0.24cm; *mentum* stout, curved, 1–5mm long. *Petals* linear-lanceolate, acute, 6–9 × 1.5–2mm. *Lip* simple, entire,

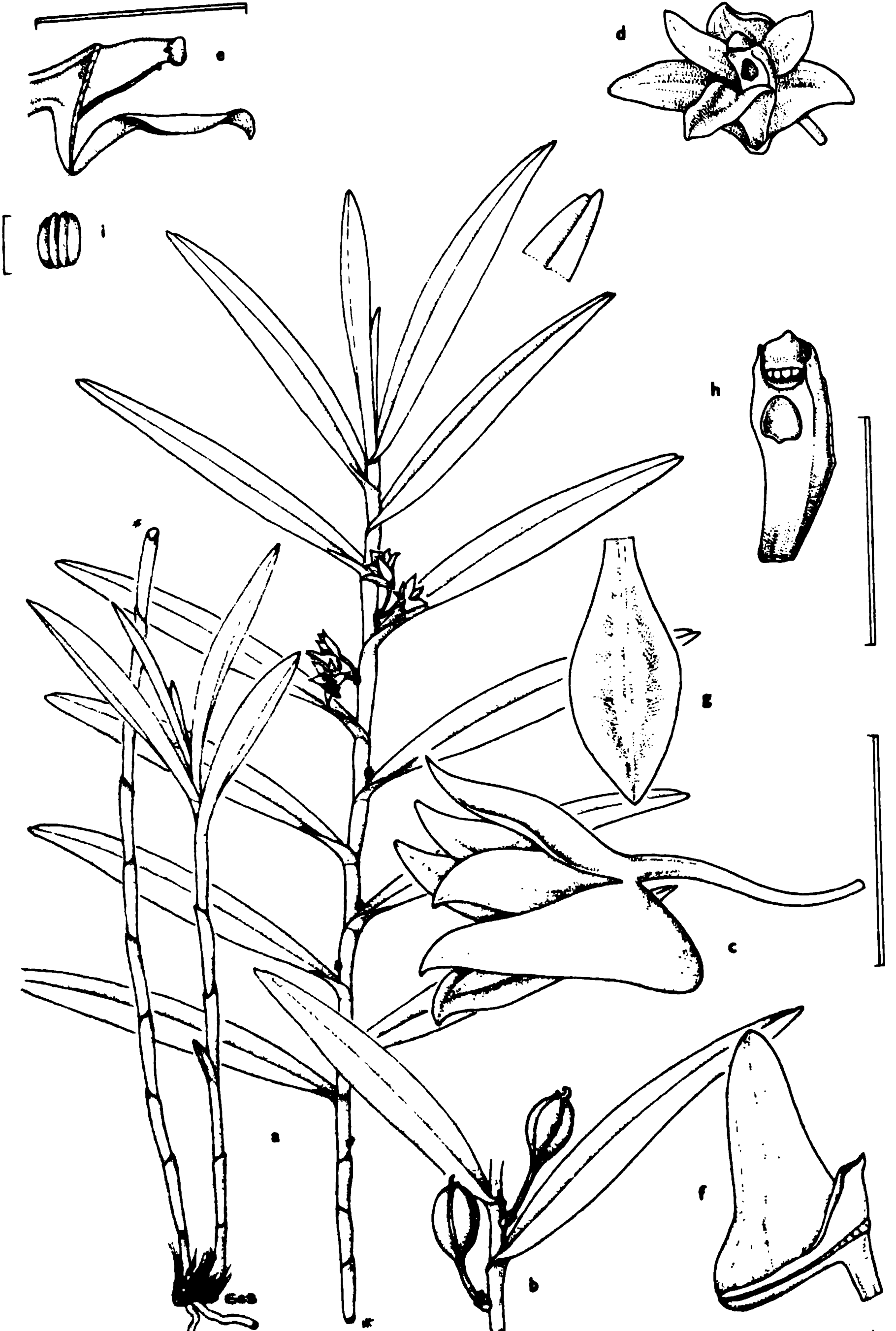

Fig. 96 *Dendrobium cathcartii*: a, habit (with detached inflorescence); b, infructescence (detail); c, flower (side view); d, flower, e, lip and column; f, column with lateral sepal; g, lip; h, column; i, pollinia. Drawn by Susanna Stuart-Smith, a–c and f–g from Pantling 114 (K); d–e and h–i from icon. in King & Pantling (1898).

elliptic-oblong, acute, 3-veined, median vein strong, 5–6mm long. Column broad, c. 3mm long; foot narrow, elongate. Fruit ovoid, 1.3–1.4 × 0.8–1cm. **Fig. 96; Plate 20.**

Bhutan: S – Sarbhang district (Singi Khola); **Darjeeling** (near Rambi Chhu); **Sikkim** (unlocalised *Pantling* specimens). In tropical valleys and subtropical evergreen forest on river banks; 330–830m. Fl. March–September.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named after John Ferguson Cathcart (1802–1851) who was born in Scotland, worked for the Bengal Civil Service and collected plants in Darjeeling.

NOTE. *D. cathcartii* is closely related to *D. salaccense* (Bl.) Lindl. but has larger yellow flowers.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

D. chrysotoxum Lindl. in Bot. Reg. 33: sub t.19, t.36 (1847). Type: E Indies, cult. Henderson (holo. [icon. in] Bot. Reg. 33: sub t.19, t.36 (1847!).

Callista chrysotoxa (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

NOTE. Reported by Bose & Bhattacharjee (1980) from Sikkim, but we have seen no material to support this report and suspect that it is probably based on a misidentification.

D. cretaceum Lindl. in Bot. Reg. 33: t.62 (1847). Types: India, Khasia, *Griffith* s.n. (syn. K-LINDL!); Myanmar, Mergui, *Griffith* s.n. (syn. K-LINDL!).

Callista cretacea (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

NOTES. Reported by Rao & Deori (1980) from Rahung to Bomdila and Rupa to Synchon in the Kameng district of Arunachal Pradesh. It belongs to section *Dendrobium* but we have seen no material from our area.

D. crystallinum Rchb. f. in Gard. Chron. 28: 572 (1868). Type: Myanmar, (Burma) cult. Veitch s.n. (holo. K!).

Callista crystallina (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 654 (1891).

NOTES. Reported by Hooker (1890) from Sikkim, but Rolfe (1902) re-examined the material and identified it as *D. pierardii* Roxb. Bose & Bhattacharjee (1980) also recorded it from Sikkim (no doubt based on Hooker's record), but we have seen no material to confirm this report.

D. lituiflorum Lindl. in Gard. Chron. 1856: 372 (1856). Types: Country of origin unknown, *Hanbury* s.n. (syn. K-LINDL!); *J. Edwards* (syn. K not found).

NOTES. Rao & Deori (1980) reported this species (which belongs to section *Dendrobium*) from the Aka Hills and Kacharigaon in the Kameng district of Arunachal Pradesh. We have seen no material from our area.

D. mannii Ridley in J. Linn. Soc., Bot. 32: 246 (1896). Types: NE India, Assam, *Mann* s.n. (syn. SING, isosyn. BM); Malaysia, Mount Ophir, *Derry* s.n. (syn. SING).

NOTES. Reported by Rao (1990) and Chowdhery (1998) from Tipi in the W Kameng district of Arunachal Pradesh. It is related to *D. anceps*, but we have seen no material from our area.

D. monticola P.F. Hunt & Summerhayes in Taxon 10(4): 110 (1961). Type: Nepal, Sheopore, coll. *Wallich* Wall. Cat. 2014 p.p. (holo. K-W!, iso. K!).

Dendrobium pusillum D. Don, Prodr. Fl. Nepal.: 35 (1825). Type: Nepal, *Wallich* s.n. (holo. BM!).

D. denudans sensu Lindl., Gen Sp. Orchid. Pl.: 84 (1830), non D. Don.
D. alpestre Royle, Ill. Bot. Himal. 1: 370, t.88 (1839). Type: India, Mussoree, *Royle* 46 (holo. LIV!).
Callista alpestris (Royle) Kuntze, Revis. Gen. Pl. 2: 654 (1891).
Dendrobium roylei A.D. Hawkes in Orquidea (Rio de Janeiro) 24: 114 (1962), nom. *superfl.*

NOTES. Seidenfaden (1985) cited a drawing by Anderson at Kew as the sole authority for the occurrence of this species in Sikkim. We have examined this drawing (dated 28 November 1867), and believe that both the drawing and the flowering time suggest that it should be referred to D. *peguanum*. Don proposed the name D. *pusillum* for this species but this was a later homonym of D. *pusillum* Kunth (now *Pleurothallis pusilla* (Kunth) Lindl.). D. *alpestre* Royle is a later homonym of D. *alpestre* (Sw) Sw. (now *Pleurothallis alpestre* (Sw.) Lindl.), so Hunt & Summerhayes (1961) proposed the name D. *monticola*.

D. nareshbahadurii Naithani in Indian Forester 112(1): 66 (1986). Type: India, Arunachal Pradesh, Kameng district, Jameri, *Bahadur & Naithani* 160 (holo. DD).

NOTE. We have seen no material of this species. It is related to D. *strongilanthum* Rchb. f. in section *Stachyobium*.

D. palpebrae Lindl. in J. Hort. Soc. London 5: 33 (1850). Type: Myanmar (Burma), Moulmein, cult. Veitch s.n. (holo. K-LINDL!).
Dendrobium farmeri var. *album* Regel in Gartenflora 17: 321, t.595 (1868). Type: Myanmar (Burma) Moulmein, cult. Low (holo. B).
Callista palpebrae (Lindl.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).

NOTES. Hooker (1895) reported and illustrated a plant from the Tista Valley in Sikkim as D. *palpebrae*. Bose & Bhattacharjee (1980), presumably following Hooker, reported it from the same locality. We agree with King & Pantling (1898) and Rolfe (1916) who considered that Hooker's plant should be referred to D. *farmeri*.

D. parciflorum Rchb. f. ex Lindl. in Proc. Linn. Soc. Lond. 3: 4 (1859). Type: India, Assam, *Jenkins* s.n. (holo. K!).

NOTES. Reported by Hegde & Rao (1982b) (as D. *kentrophyllum* Hook. f.) from the Tirap district in Arunachal Pradesh and by Chowdhery (1998) from the W Kameng district. Seidenfaden (1985) discussed the taxonomy of this species and the confusion with D. *kentrophyllum*. We have seen no members of section *Strongyle* Lindl. (to which it belongs) from our area.

D. parishii Rchb. f. in Bot. Zeitung (Berlin) 21(31): 237 (1863). Type: Myanmar (Burma), Moulmein, *Parish* 18 (holo. W! Herb. no. 20943, iso. K!).
Callista parishii (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).

NOTE. Chowdhery (1998) reported this member of sect. *Dendrobium* from the Kameng district of Arunachal Pradesh.

D. primulinum Lindl. in Gard. Chron. 18: 400 (1858). Type: India, cult. Warner s.n. (holo. K-LINDL!).
Dendrobium nobile var. *pallidiflorum* Hook., in Bot. Mag. 83: t.5003 (1857). Type cult., without provenance
Callista primulina (Lindl.) Kuntze, Revis. Gen. Pl. 2: 655 (1891).

NOTES. Reported by Hooker (1890) from Sikkim, but Rolfe (1902) re-examined the material and referred it to D. *pierardii* Roxb. ex Hook. Bose & Bhattacharjee (1980) also recorded it from Sikkim, no doubt following Hooker, but we have seen no material to confirm this report.

D. pulchellum Roxb. ex Lindl., Gen. Sp. Orchid. Pl.: 82 (1830). Type: Bangladesh, Sylhet, [icon. of] '*Dendrobium pulchellum*' Roxburgh 2356 (holo. CAL, iso. K!).
Dendrobium dalhousieanum Wall. in Paxton's Mag. Bot. 11: 145 + fig. (1844). Type: India, without provenance, cult. (holo. [icon. in] Paxton's Mag. Bot. 11: 145 + fig. (1844)!).
Callista pulchella (Roxb. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 655 (1861).

NOTES. Reported by Hooker (1890) from Sikkim, but Rolfe (1902) re-examined the material and referred it to *D. hookerianum* Lindl. Bose & Bhattacharjee (1980) also recorded it from Sikkim, no doubt following Hooker, but we have seen no material to confirm this report.

D. thyrsiflorum Rchb. f. ex E. André in Ill. Hort. 22: 88, t.207 (1875). Type: Myanmar (Burma), Tenasserim, *Parish* 190 (holo. K!).
Dendrobium densiflorum var. *alboluteum* Hook. f. in Bot. Mag. 95: t.5780 (1869). Type cited above.

NOTES. Hooker described var. *alboluteum* that he, Reichenbach and Buller (who had cultivated the plant) considered to be a variety of *D. densiflorum*. The name *D. thyrsiflorum* had apparently been coined by Reichenbach but was only validly published in 1875. Schelpe (1981) did not indicate a type specimen for *D. thyrsiflorum* and treated var. *alboluteum* as conspecific with *D. farmeri*. Seidenfaden (1985) considered that *Parish* 190 (K) should be considered the type of *D. thyrsiflorum* and that var. *alboluteum* was conspecific. Some early authors did not recognise *D. thyrsiflorum* while Tsi (1980) and other Chinese authors still treat it as conspecific with *D. densiflorum*. Schelpe (1981) and Seidenfaden (1985) treated it as a separate entity with a distribution extending from S China, lower Myanmar, through N Thailand to Laos. It is related to *D. farmeri* but differs in having a many-ridged pseudobulb and a denser inflorescence.

We remain unsure about both its taxonomic treatment and its presence in our area. It has been reported by Bose & Bhattacharjee (1980) but we have not been able to confirm this. Clearly a white and yellow *Dendrobium* does occur and only further field study will decide whether the plants are referrable to *D. farmeri* or *D. thyrsiflorum*.

D. wardianum Warner, Select Orchid. Pl. 1: t.19 (1862). Type: NE India, cult. Ward, [icon.] from cult. Day (holo. [icon. in] Select Orchid. Pl. 1: t.19 (1862)!).
Callista wardiana (Warner) Kuntze, Revis. Gen. Pl. 2: 655 (1891).

NOTES. Reported by Würmli (1973) from Bhutan, but we have been unable to locate his collection. It is very closely related to *D. falconeri* and has previously been reported from NE India (though not from Sikkim) and Myanmar. Its unbranched stem is generally thicker than that of *D. falconeri*.

96. **Epigenium** Gagnepain

Plants epiphytic or lithophytic, small to medium in size, often forming large clumps; *rhizomes* elongate. *Pseudobulbs* ovoid, usually enclosed in sheaths. *Leaves* 1 or 2, arising from pseudobulb apex, oblong to obovate, coriaceous. *Inflorescence* terminal from pseudobulb, racemose, 1- to several-flowered; floral bracts spathe-like. *Flowers* medium to large in size, often showy. *Dorsal sepal* enclosing the column; *lateral sepals* larger than dorsal sepal, oblique, adnate at base to form a mentum. *Petals* triangular, long-decurrent on the mentum. *Lip* pandurate-oblong, simple to 3-lobed; disc with a lobulate or ridged callus on basal part. *Column* short; foot long; stelidia short (when present); pollinia 4, in 2 pairs, naked.

The genus *Epigenium* was proposed in 1932 by F. Gagnepain in the *Bulletin du Muséum d'Histoire Naturelle*, Paris. The complex taxonomy of the genus was discussed by Seidenfaden (1980) and we follow his treatment here. Balakrishnan & Chowdhury (1966) reviewed the Bhutanese species. The genus comprises about 35 species distributed from India, China, SE Asia and Indonesia to the Philippines.

Garay & Romero-Gonzalez (1999) proposed a sectional treatment for Epigenium which we follow here.

TYPE. *Epigenium fargesii* (Finet) Gagnepain; basionym: *Dendrobium fargesii* Finet.
ETYMOLOGY. From the Greek *epi-* (upon) and *geneion* (chin) in reference to the position of the petals and lateral sepals in relation to the column foot.

Key to species

1. Plants with 1 leaf .... **1. E. fargesii**
+ Plants with 2 leaves 2

2. Pseudobulbs more than 15cm tall; leaves more than 10cm long; flower more than 7cm across **2. E. amplum**
+ Pseudobulbs less than 15cm long; leaves less than 10cm long; flower less than 5cm across . 3

3. Lateral lobes of lip not touching the column 4
+ Lateral lobes of lip touching or overlapping the column 5

4. Lateral lobes of lip broad .... **3. E. fuscescens**
+ Lateral lobes of lip narrow .... **6. E. treutleri**

5. Petals linear-lanceolate; flowering September to October; .... **4. E. navicularis**
+ Petals broadly lanceolate; flowering April to May; .... **5. E. rotundatum**

Section Epigenium

1. **E. fargesii** (Finet) Gagnepain in Bull. Mus. Natl. Hist. Nat. ser.2, 4: 593 (1932). Type: China, Szechuan (Sichuan), Tchen-Keou-Tin, *Farges* 1506 (holo. P, iso. CAL K! LE! NY!).
Dendrobium fargesii Finet in Bull. Soc. Bot. France 50: 374, f.12 (1903).
Desmotrichum fargesii (Finet) Kränzlin in Engler, Pflanzenr. (IV.50) Dendrob. 1: 358 (1910).
Sarcopodium fargesii (Finet) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 83 (1951).

Plant epiphytic; *rhizome* prostrate, creeping, branched, c.2mm thick; *roots* arising from nodes, 2–2.5cm long. *Pseudobulbs* inserted 0.5–1cm apart on rhizome, ribbed, ellipsoid-fusiform, weakly curved, 1.4–1.7 × 0.5–0.7cm. *Leaf* 1, from pseudobulb apex, coriaceous, obovate-oblong, obtuse, petiolate, strongly 1-veined, 1.5–2.5 × 0.7–1cm; petiole 3–5mm long. *Inflorescence* racemose, 1-flowered; floral bract ovate, acute, c.5mm long. *Flower* 2.5–3cm wide, dark purplish-brown; pedicel and ovary 1–1.5cm long. *Dorsal sepal* erect, triangular, acute, 5-veined, 0.8–1 × 0.6–0.7cm; *lateral sepals* falcate, triangular-lanceolate, acute, 9-veined, adnate to column foot to form a mentum, 2–2.2 × 0.7–1cm. *Petals* erect, obliquely triangular, acute, 3-veined, 0.9–1 × 0.2–0.3cm. *Lip* clawed at base, expanded and pandurate (when spread), 3-lobed, margins induplicate, 2–2.2 × 1–1.2cm; lateral lobes wedge-shaped to orbicular; mid-lobe reniform, broadly 2-lobed, weakly emarginate; disc strongly 2-keeled to base of mid-lobe. *Column* apex attenuate, c.4mm long; stelidia ± obsolete; foot elongate, 1.3–1.5cm long.
Bhutan: S – Deothang district (Narfong (M.F.B.)); 1200–1775m. Fl. June(–September).

GENERAL DISTRIBUTION. China and Thailand.
ETYMOLOGY. Named after Paul Guillaume Farges (1844–1912), a French missionary who collected plants in China.

Section **Katherinea** (A.D. Hawkes) Garay & Romero-Gonzalez in Harvard Pap. Bot. 4(2): 479 (1999).

2. **E. amplum** (Lindl.) Summerhayes in Kew Bull. 12: 260 (1957). Types: Nepal, Thoka, coll. Wallich Wall. Cat. 2001.1 (syn. K-LINDL!, isosyn. CAL K-W!); Bangladesh, Pandua, coll. F De Silva Wall. Cat. 2001.2 (syn. K-LINDL!, isosyn. CAL K-W!).

Dendrobium amplum Lindl., Gen. Sp. Orchid. Pl.: 74 (1830).

Sarcopodium amplum (Lindl.) Lindl., Fol. Orchid. Sarcopodium 2: 1, no.1 (1853).

Bulbophyllum amplum (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 244 (1861).

Dendrobium coelogyne Rchb. f. in Gard. Chron. 1871: 137 (1871). Tye: Myanmar (Burma), Moulmein, Parish (holo. W! Herb. no. 54268).

Sarcopodium coelogyne (Rchb. f.) Rolfe in Orchid Rev. 18: 238 (1910).

Katherinea ampla (Lindl.) A.D. Hawkes in Lloydia 19: 95 (1956).

K. coelogyne (Rchb. f.) A.D. Hawkes in Lloydia 19: 95 (1956).

Epigenium coelogyne (Rchb. f.) Summerhayes in Kew Bull. 12: 261 (1957).

Plant epiphytic or lithophytic; *rhizome* stout, creeping, branched; *roots* arising from nodes. *Pseudobulbs* obliquely ellipsoid, rugose-grooved, inserted 5–12cm apart on rhizome, sheathed, 3.8–5 × 1.5–2.2cm; sheaths membranous, many-veined, ovate, acute, 4–4.5 × 1.5–1.8cm. *Leaves* 2, broadly elliptic-oblong, obtuse, notched at apex, sessile to shortly petiolate, 10–15 × 3–4.5cm; petiole 1.5–2.5cm long. *Inflorescence* 1-flowered; floral bract large, ovate-oblong, acute, sheathing, 1.5–4 × 0.6–0.8cm. *Flower* 7–8cm across, cream to yellowish, mottled with purple-red, lip deep purple to chocolate-brown; pedicel and ovary 3.5–5.5cm long. *Dorsal sepal* lanceolate, acute to acuminate, 4–6.3 × 1–1.2cm; *lateral sepals* lanceolate, falcate, acute, saccate at base, 4.2–4.5 × 1.4–1.6cm. *Petals* linear-lanceolate, acute, 4.5–5 × 0.3–0.8cm. *Lip* 3-lobed, porrect, 3–4.5 × 1.5–2cm; lateral lobes suborbicular, erect; mid-lobe rhombic-ovate, recurved at apex, margins crisped; disc 3-lamellate. *Column* weakly curved, narrowly winged, 2cm long. **Plate** 23.

Bhutan: C – Punakha district (between Wache and Ngawang); **Darjeeling** (unlocalised Gamble specimen); **Sikkim** (Lusing, Rimbi Chhu, Yoksam). On *Quercus* and *Rhododendron* sp., in warm broad-leaved forest, on rocks; 1000–2000m. Fl. October.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and Thailand.

ETYMOLOGY. From the Latin *amplus* (abundant, large) probably a reference to the plant's habit.

3. **E. fuscescens** (Griff.) Summerhayes in Kew Bull. 12: 262 (1957). Type: India, Assam, Khasia Mountains, Churra, *Griffith* 5157 (holo. K!).

Dendrobium fuscescens Griff., Not. Pl. Asiat. 3: 308 (1851); Ic. Pl. Asiat. 3: t.309 (1851).

Sarcopodium fuscescens (Griff.) Lindl., Fol. Orchid. Sarcopodium 2: 2, no.2 (1853).

Bulbophyllum fuscescens (Griff.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 244 (1861).

Katherinea fuscescens (Griff.) A.D. Hawkes in Lloydia 19: 95 (1956).

Plant epiphytic or lithophytic; *rhizome* creeping, often branched, with overlapping sheaths. *Pseudobulbs* narrowly cylindric-ovoid, inserted 5.5–9.5cm apart on rhizome, 2.2–4 × 0.5–0.7cm. *Leaves* 2, narrowly elliptic-lanceolate, coriaceous, sessile to shortly petiolate, 6–11.5 × 1.1–3.1cm; petiole 2–3mm long. *Inflorescence* 1-flowered; peduncle sheathed, 3–6mm long; floral bract ovate-lanceolate, acute, c.8 × 3mm. *Flower* 4–4.5cm across, pale brownish purple; pedicel and ovary 1.5–1.8cm long. *Dorsal sepal* ovate-lanceolate, acute, spreading, 1.7–2 × 0.4–0.8cm; *lateral sepals* ovate-lanceolate, weakly falcate, acute, spreading, adnate to column foot to form a mentum, 2.1–2.4 × 0.5–1cm. *Petals* linear-lanceolate, 5-veined, spreading, 1.5–2.3 × 0.1–0.3cm. *Lip* 3-lobed, mobile, broadly ovate-oblong (when spread), 1.5–2 × 1–1.4cm; lateral lobes narrowly oblong, obtuse; mid-lobe suborbicular, emarginate to

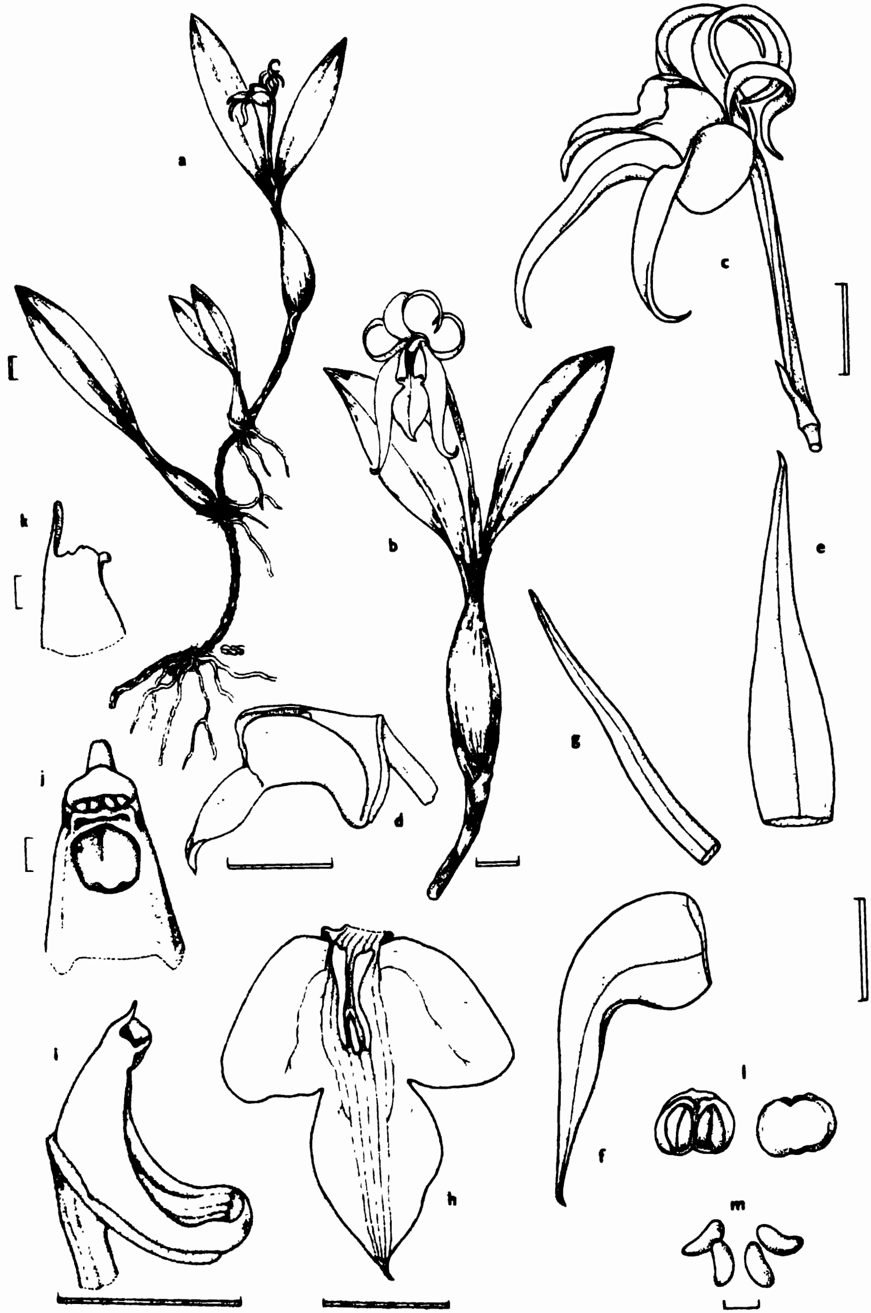

Fig 97 *Epigeneium navicularis*: a–b, habit; c, flower; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column (side view); j, column apex (front view); k, column apex (side view); l, anther cap (two views); m, pollinia. Drawn by Susanna Stuart-Smith, a from *Balakrishnan* 43014A (CAL); b–m from *Grierson & Long* 4841 (E)

minutely mucronate at apex; disc unequally 3-lamellate. Column narrowly winged at base, c.1cm long; foot curved, c.9mm long. Fruit ridged, c.2.5 × 0.7cm.

Bhutan: C – Punakha (Lamperi, Ritang, Samtengang), Tongsa (Tongsa bridge to Tongsa), Bumthang/Mongar (Rudong La) and Tashigang (Gamri Chu) districts; **Darjeeling** (Dumsong, Sureil); **Sikkim** (Lachung Valley, Yoksam). On moss-covered rocks in forest; 1660–2800m. Fl. October.

GENERAL DISTRIBUTION. Nepal, NE India and China.

ETYMOLOGY. From the Latin *fuscus* (swarthy brown) and *-escens* (-ish) in reference to the flower colour.

4. **E. navicularis** (N.P. Balakrishnan & S. Chowdhury) A.N. Rao in J. Econ. Taxon. Bot., Addit. Ser. 11: 59 (1995). Type: Bhutan, Narfong, *Balakrishnan* 43014 (holo. CAL, iso. ASSAM).

Katherinea navicularis N.P. Balakrishnan & S. Chowdhury in Bull. Bot. Surv. India 8: 316 (1966).

Plant epiphytic; *rhizome* branched, 3–4mm thick, covered by overlapping, tubular sheaths. *Pseudobulbs* 1-noded, narrowly ellipsoid-cylindric, terete, smooth, sheathed at base, inserted 2–6.5cm apart on rhizome, 3.5–4 × 1–1.5cm; sheaths lanceolate, c.1.2–2.5cm. *Leaves* 2, persistent, opposite, elliptic-oblong, subobtuse, apex emarginate, thinly coriaceous, 1-veined, 3.5–8.5 × 1.5–2.5cm. *Inflorescence* 1-flowered; peduncle sheathed, c.1cm long; sheath elliptic-ovate, subacute, scarious, c.2.2 × 1cm; floral bract linear-lanceolate, acuminate, 1-veined, 0.9–1.1 × 0.2–0.3cm. *Flower* c.4 × 4.5cm, dull purple-brown; pedicel and ovary 2.7–3.2cm long. *Dorsal sepal* ovate-lanceolate, acuminate, 2.8–3.6 × 0.9–1cm; *lateral sepals* falcate-lanceolate, acuminate, adnate at base to the column foot, 2.7–3 × 1–1.1cm. *Petals* linear-lanceolate, acuminate, spreading, 2.8–2.9 × 0.2–0.25cm. *Lip* 3-lobed, ovate-acute (when spread), 1.8–2.1 × 1.1–1.7cm; lateral lobes incurved, enclosing the column, c.1.1 × 0.8cm; mid-lobe ovate, acuminate; disc with 3 continuous, parallel ridges from base of lip to base of mid-lobe, 1.2 × 0.9cm. Column curved, broadly winged, 1.2–1.8cm long; foot short. **Fig. 97.**

Bhutan: S – Gaylegphug (Gaylegphug) and Deothang (Narfong) districts. In warm evergreen broad-leaved forest; 1720m. Fl. September–October.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. From the Latin *navicularis* (boat-shaped) in reference to the cavity formed by the column margins.

5. **E. rotundatum** (Lindl.) Summerhayes in Kew Bull. 12: 264 (1957). Type: India, Sikkim, *Hooker* 24 (holo. K-LINDL!).

Sarcopodium rotundatum Lindl., Fol. Orchid. Sarcopodium 2: 2, no.3 (1853).

Bulbophyllum rotundatum (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 244 (1861).

Dendrobium rotundatum (Lindl.) Hook. f., Fl. Brit. India 5(2): 712 (1890).

Katherinea rotundatum (Lindl.) A.D. Hawkes in Lloydia 19: 97 (1956).

Plant epiphytic or lithophytic; *rhizome* creeping. *Pseudobulbs* ovoid, partly sheathed, inserted 4–10cm apart on rhizome, sheathed, 2.5–4 × 1.2–1.5cm; sheaths membranous, lanceolate-ovate, acuminate, 3.5–4 × 1.5–2cm. *Leaves* 2, oblong-elliptic, apex notched, 6.5–10 × 2.5–3.5cm. *Inflorescence* 1-flowered; floral bract lanceolate, subacute, 3–3.2 × 0.8–1.2cm. *Flower* 4–4.5cm across, pale brown; pedicel and ovary 3cm long. *Dorsal sepal* broadly ovate, fleshy, spreading, 9-veined, 2.2–3.2 × 0.6–1.2cm; *lateral sepals* falcate, ovate, subacute, adnate on column foot, 7-veined, 2.2–0.6cm. *Petals* oblong, acute, 7-veined, margins weakly undulate, 1.9 × 0.5–0.6cm. *Lip* broadly 3-lobed, attached at base of column foot, 1.5–2 × 1–1.6cm (when spread); lateral lobes broadly orbicular; mid-lobe sub-reniform to obscurely 2-lobed, apex emarginate, margins thin, undulate, with a triangular thickening; disc 3-keeled. Column curved, toothed, 7–9mm long; foot 6–7mm long.

Bhutan: S – Chukka (Raidak Valley, Tabji Khola) and Gaylegphug (Gale Chu Valley) districts; C – Punakha district (Chusom, Kyebakha); **Darjeeling** (Happy Valley, above Lopchu, below Patasi, Victoria Falls); **Sikkim** (Rimbi Chhu). On trees and shaded rocks; 1300–2400m. Fl. April–May.

GENERAL DISTRIBUTION. Nepal, India, Myanmar and China.
ETYMOLOGY. From the Latin *rotundatus* (rounded) in reference to the lateral lobes of the lip.

6. **E. treutleri** (Hook. f.) Ormerod in Oasis 1(3): 3 (2000). Type: India, Sikkim Himalaya, *Treutler* s.n. (holo. K!).
Coelogyne treutleri Hook. f., Fl. Brit. India 5(2): 837 (1890); Icon. Pl. 22: t.2105 (1894).
Epigenium yunnanense Tang & Z.H. Tsi in Acta Phytotax. Sin. 22(6): 484 (1984). Type: China, Yunnan, Nu Jiang, *T.T. Yü* 20888 (holo. PE).

Plant epiphytic; *rhizome* creeping, stout, naked. *Pseudobulbs* ovoid, small, inserted 1–6.5cm apart on rhizome, 1.5–2.5 × 0.4–0.5cm. *Leaves* 2, elliptic-lanceolate, acute, 1-veined, sessile, 2.5–6.5 × 0.7–1.4cm. *Inflorescence* hysteranthous, 1-flowered; peduncle long-sheathed at base, 1.8–2cm long; rachis short; floral bract subobovate, obtuse-mucronate, membranous, 9 × 4mm. *Flower* c.4cm across, uniformly pale purple; pedicel and ovary c.1.5mm long. *Sepals* similar, lanceolate, acuminate, 7- to 9-veined, 1.6–2.3 × 0.5–0.7cm. *Petals* linear, 5-veined, 1.6–2.3 × 0.5cm long. *Lip* broadly 3-lobed, clawed and saccate at base, c.1.5 × 1.1cm (across mid-lobe, when spread); lateral lobes broadly ovate, margins entire, 1.4–1.6 × 0.4–0.6cm; mid-lobe rhombic to orbicular, base wedge-shaped, apex rounded; disc 3-keeled from lip base to base of mid-lobe, becoming veined towards apex. *Column* narrowly winged, apiculate, c.1cm long.

Sikkim (unlocalised *Treutler* specimen). Fl. May.

GENERAL DISTRIBUTION. NE India and China.
ETYMOLOGY. Named after William John Treutler (1841–1915) who collected plants (including the type of this species) in Sikkim in 1874.
NOTE. Ormerod showed that this little-known species, known only from the two type specimens, did not belong to *Coelogyne*.

97. Flickingeria A.D. Hawkes

Plants epiphytic or lithophytic, erect; *rhizomes* creeping, rooting. *Stems* several-noded, apical node swollen, sheathed (when young), branched from upper nodes to form elongate, superposed erect or pendent clumps. *Leaf* single, coriaceous, erect. *Inflorescences* several, axillary, terminal or subterminal, 1-flowered. *Flowers* ephemeral, thinly membranous. *Sepals* subsimilar; lateral sepals oblique, adnate at base to form a chin-like mentum with the column foot. *Petals* narrower than sepals. *Lip* complex, 3-lobed; hypochile short, concave, with 2 erect lateral lobes; mesochile oblong, clawed; epichile 2-lobed, transversely oblong to reniform, often pleated or lacerate; callus of 2 or 3 raised, longitudinal lamellae. *Column* short, fleshy, with a distinct foot; pollinia 4, in 2 appressed pairs.

The genus *Flickingeria* was established in 1961 by A.D. Hawkes in *Orchid Weekly*. Blume had used the name *Desmotrichum* for this segregate genus of *Dendrobium* but Hawkes (1961, 1965) pointed out that the name was a homonym of the conserved name *Desmotrichium* Kützing (an algal genus) and proposed the new name. The same observation was made by Hunt & Summerhayes (1961) and they proposed the name *Ephemerantha* but Hawkes' name is considered to have priority by a matter of a few days. The genus comprises about 60 species distributed in SE Asia, the Malay Archipelago, the Pacific Islands and NE Australia.

Rasmussen (1982b) discussed the modular growth pattern of this genus.

TYPE. *Flickingeria angulata* (Bl.) A.D. Hawkes; basionym: *Desmotrichum angulatum* Bl.
ETYMOLOGY. Named after Edward A. Flickinger, a friend of A.D. Hawkes.

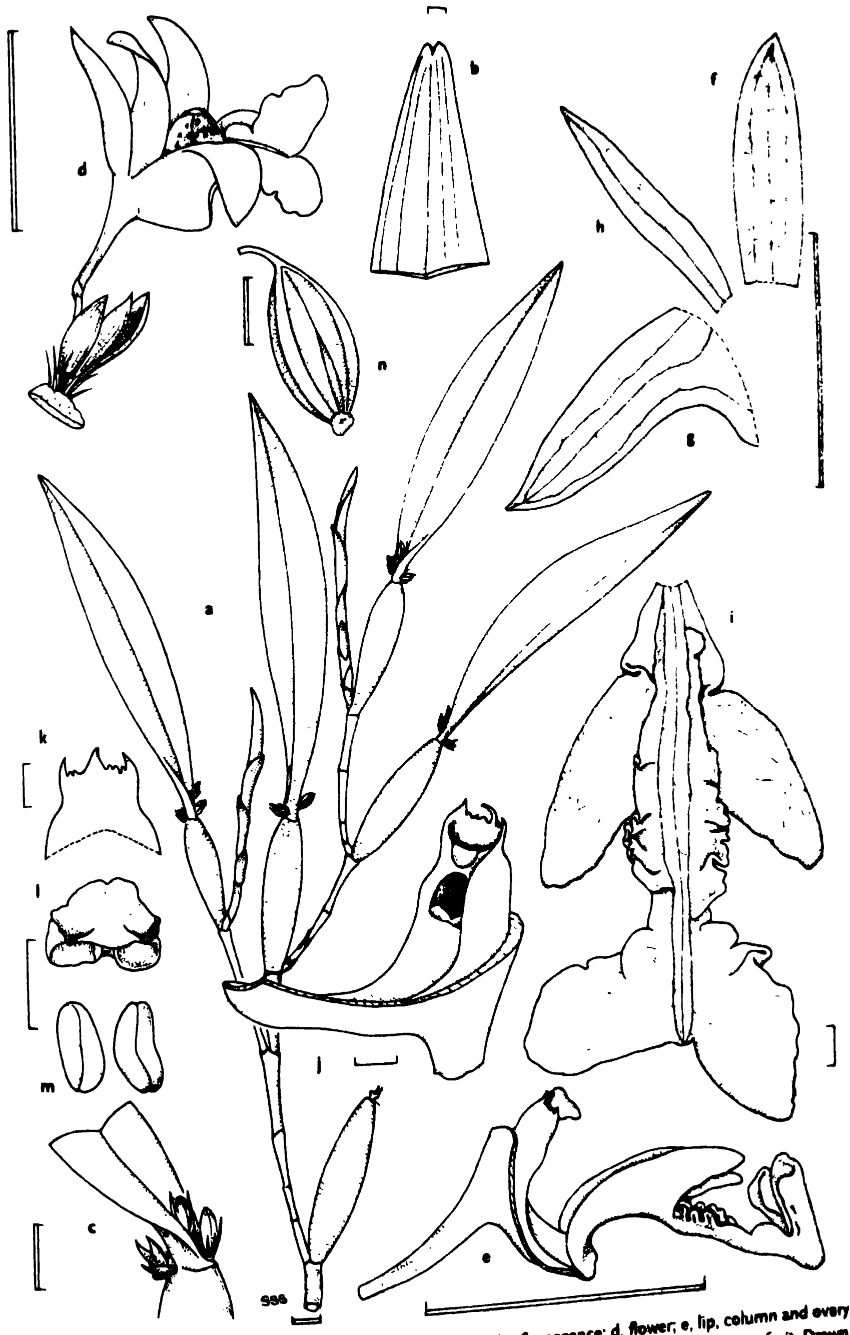

Fig. 98. ***Flickingeria fugax***: a, habit; b, leaf apex; c, leaf base and inflorescence; d, flower; e, lip, column and ovary; f, dorsal sepal; g, lateral sepal; h, petal; i, lip; j, column; k, column apex; l, anther cap; m, pollinia; n, fruit. Drawn by Susanna Stuart-Smith. a–c from *Pantling* 266 (K); d–n from *Sargent* 20 (K).

1. F. fugax (Rchb. f.) Seidenfaden in Dansk Bot. Ark. 34(1): 46 (1980). Types: Myanmar (Burma), Moulmein, icon. (syn. W! Herb. no.54318); p.p. (syn. W! Herb. no. 54319); icon. Day (syn. K! [icon. in] J. Day, Drawings of Orchids, Book 16: t.59 (1870)).

Dendrobium fugax Rchb. f. in Gard. Chron. 1871: 1257 (1871).

D. sordidum King & Pantling in J. Asiat. Soc. Bengal 66(3): 583 (1897). Type: Burma, cult. Calcutta, *Pantling* 539 (holo. CAL!).

Plant epiphytic, pendent. *Stems* long, pendent, branched, yellow; internodes 1.5–2.5cm long; *pseudobulbs* borne on stem nodes, narrowly fusiform, ± compressed, shining, grooved, 3–5 × 0.4–0.8cm. *Leaf* 1, terminal from pseudobulb, linear-oblong to narrowly oblong-elliptic, minutely emarginate, veined, sessile, 7–16 × 1.7–2.7cm. *Inflorescences* adaxial and abaxial, 1- or 2-flowered; peduncle sheathed, short; sheaths overlapping, lanceolate, acute, membranous, 3–5mm long; floral bracts triangular, 0.5–1mm long. *Flowers* 0.8–1.5cm long; sepals and petals white (when fresh), lip white, apex green-yellow (with age), lateral lobes marked with purple spots; pedicel and ovary glabrous, 5–6mm long. *Dorsal sepal* elliptic-oblong to oblong, subacute, spreading, 5-veined, c.1 × 0.4cm; *lateral sepals* elliptic-oblong, subacute, adnate at base to form a mentum, 1–1.2 × 0.3–0.6cm (at base); *mentum* short, broad, conical. *Petals* narrowly elliptic-oblong, subacute, c.1 × 0.1–0.2cm. Lip complex, oblong-obovate (when spread), 1–1.3 × 0.6–0.7cm (when spread); hypochile wedge-shaped; lateral lobes erect, oblong, c.3mm long; mesochile narrow, margins plicate; epichile broadly oblong-elliptic, apex truncate to obscurely 2-lobed, margins undulate; disc with 2 plicate lamellae from hypochile base to epichile. *Column* 6–7mm long, apical margin denticulate; foot medium; anther cap c.1.3mm wide. Fruit ovoid, c.2 × 1.2cm. **Fig. 98.**

Bhutan: S – Sarbhang district (near Sarbhang, Mankhola river); C – Punakha district (Punakha Valley (field record), Rimchu); **Darjeeling** (unlocalised *Gamble* specimens); **Sikkim** (unlocalised *Pantling* specimen). In tropical valleys, on trees in broad-leaved forest, on *Duabanga grandiflora* by riverbank, on *Schima wallichii* on hillside; 1000–1650m. Fl. May–July; Fr. May.

GENERAL DISTRIBUTION. NE India, Myanmar and Thailand.

ETYMOLOGY. From the Latin *fugax* (ephemeral) in reference to the flowers.

NOTES. Plants from Sikkim have, since King & Pantling (1898), been referred to as F. *macraei* (Lindl.) Seidenfaden (*Dendrobium macraei* Lindl.), but this species occurs only in Sri Lanka and S India. Seidenfaden (1980) thought that the Sikkim material should be referred to F. *fugax* but was unsure through lack of good material. We have been able to examine material with fresh flowers and agree with Seidenfaden.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

F. bancana (J.J. Smith) A.D. Hawkes in Orchid Weekly. 2(46): 452 (1961); Orquídea (Rio de Janeiro) 27(5): 302 (1965). Type: Sumatra, Bangka, cult. Bogor 139 (holo. L! Herb. no. 91015446, iso. K!).

Dendrobium bancanum J.J. Smith in Bull. Dép. Agric. Indes Néerl. 22: 23 (1909).

NOTE. Reported by Hegde & Rao (1985) from Sessa in the W Kameng district of Arunachal Pradesh.

F. fimbriata (Bl.) A.D. Hawkes, Orchid Weekly 2(46): 454 (1961). Type: Java, Nusae Kambangae, *Blume* s.n. (holo. L! Herb. no. 902322698).

Desmotrichum fimbriatum Bl., Bijdr.: 329 (1825).

NOTES. Reported by Bose & Bhattacharjee (1980) from Sikkim. This species has an adaxial inflorescence only, but all the specimens we have seen have both adaxial and abaxial inflorescences and are referable to F. *fugax*.

Subtribe **Bulbophyllinae** Schltr.

98. **Acrochaene** Lindl.

Plants epiphytic. *Pseudobulbs* with a single leaf. *Leaf* long-petiolate. *Inflorescence* basal, racemose, pendent. *Dorsal sepal* free, spreading; *lateral sepals* adnate to column foot to form a short mentum. *Petals* with long fimbriate margins. *Lip* 3-lobed, shortly clawed, jointed with apex of column foot. *Column* short; foot long; anther cap 2-celled; pollinia 2, subglobose, cleft; stipes 2, narrow, attached at base to a small viscidium.

The monotypic genus *Acrochaene* was established in 1853 by John Lindley in his *Folia Orchidacea*. The species was transferred to *Monomeria* by Schlechter, but Hamer & Siegerist (1994) and Seidenfaden (1995) considered this inappropriate. *Acrochaene* differs in having 2 (not 4) cleft pollinia, lateral sepals attached along (not distally only) the column foot, 2 (not 1) separate stipes, and petals that are distinctly spreading (rather than attenuate and attached to the base of the column foot). The genus occurs in NE India and Bhutan.

TYPE. *Acrochaene punctata* Lindl.
ETYMOLOGY. From the Greek *akro-* (point) and *chaeno* (to gape) in reference to the lax inflorescence.

1. A. punctata Lindl., Fol. Orchid. Acrochaene 2: 1, no.1 (1853). Type: India, Sikkim, *Hooker* 40 (holo. K-LINDL!).
Bulbophyllum kingii Hook. f., Fl. Brit. India 5(2): 760 (1890); Icon. Pl. 21: t.2053 (1892). Type: Sikkim, *King* (holo. CAL).
Monomeria punctata (Lindl.) Schltr., Orchideen: 338 (1914).

Rhizome stout, woody; *roots* densely clustered. *Pseudobulbs* ovoid to globose, rugose, 2–3 × 1–2.5cm, inserted at intervals of 3–4.5cm along rhizome. *Leaf* oblong-elliptic, apex retuse-emarginate, long petiolate, strongly keeled below, 13.5–17.5 × 3–4.3cm; petiole 9cm long. *Inflorescence* laxly many-flowered; peduncle sheathed, stout, 5–9cm long; sheaths lanceolate, acute, mouth wide, overlapping at base, 1.3–2.1 × 0.4–0.8cm; rachis glabrous, 12–19cm long; floral bracts ovate-lanceolate, acute, 0.9–1.5 × 0.2–0.6cm. *Flowers* glaucous, 1.4–2cm across; sepals and petals pale yellow-green, spotted and striped with red-pink, lip pale yellow-green, spotted with pink, column green-white; pedicel and ovary slender, glabrous, 1.4–1cm long. *Dorsal sepal* elliptic-ovate, acute, 7-veined, 0.8–1 × 0.45–0.5cm; *lateral sepals* broadly triangular, weakly falcate, acute, base adnate to column foot, weakly gibbous and forming a mentum, 7-veined, 7–9 × 4.5–5.5mm (at base). *Petals* spreading, lanceolate, acute, margins deeply fimbriate, 1-veined, 5–8 × 1.5–2mm. *Lip* 3-lobed, shortly clawed, adnate to apex of column foot, 4.5–6mm long; lateral lobes erect, short, apical margin dentate; mid-lobe oblong, deeply grooved centrally, apex obtuse. *Column* 1.5–2mm long; foot 4.5–5mm long; anther cap 1.8cm across; stipe 2-armed, c.0.25mm long; viscidium small; pollinia 2, cleft, c.1mm across. *Fruit* ovoid, ridged, long stalked, 1.5 2 × 0.8–1cm; stalk 1.6–2cm long. **Fig. 99.** 435

Bhutan: (without precise locality (M.F.B.)); **Sikkim** (Dangring). 1330–2160m. Fl. October–November.

GENERAL DISTRIBUTION. NE India, Myanmar and Thailand.
ETYMOLOGY. From the Latin *punctatus* (spotted) in reference to the red-spotted flowers.
NOTES. The illustrations of the pollinaria in King & Pantling (1898) and Seidenfaden (1995) show a single, broad stipe. The drawing on the type sheet, however, clearly shows 2 separate stipes of the *Sunipia* form which Seidenfaden (1995) considered to be erroneous. Examination of the type material confirms that the drawings are accurate suggesting that perhaps the stipes adhere in some material, or at some stage of development.

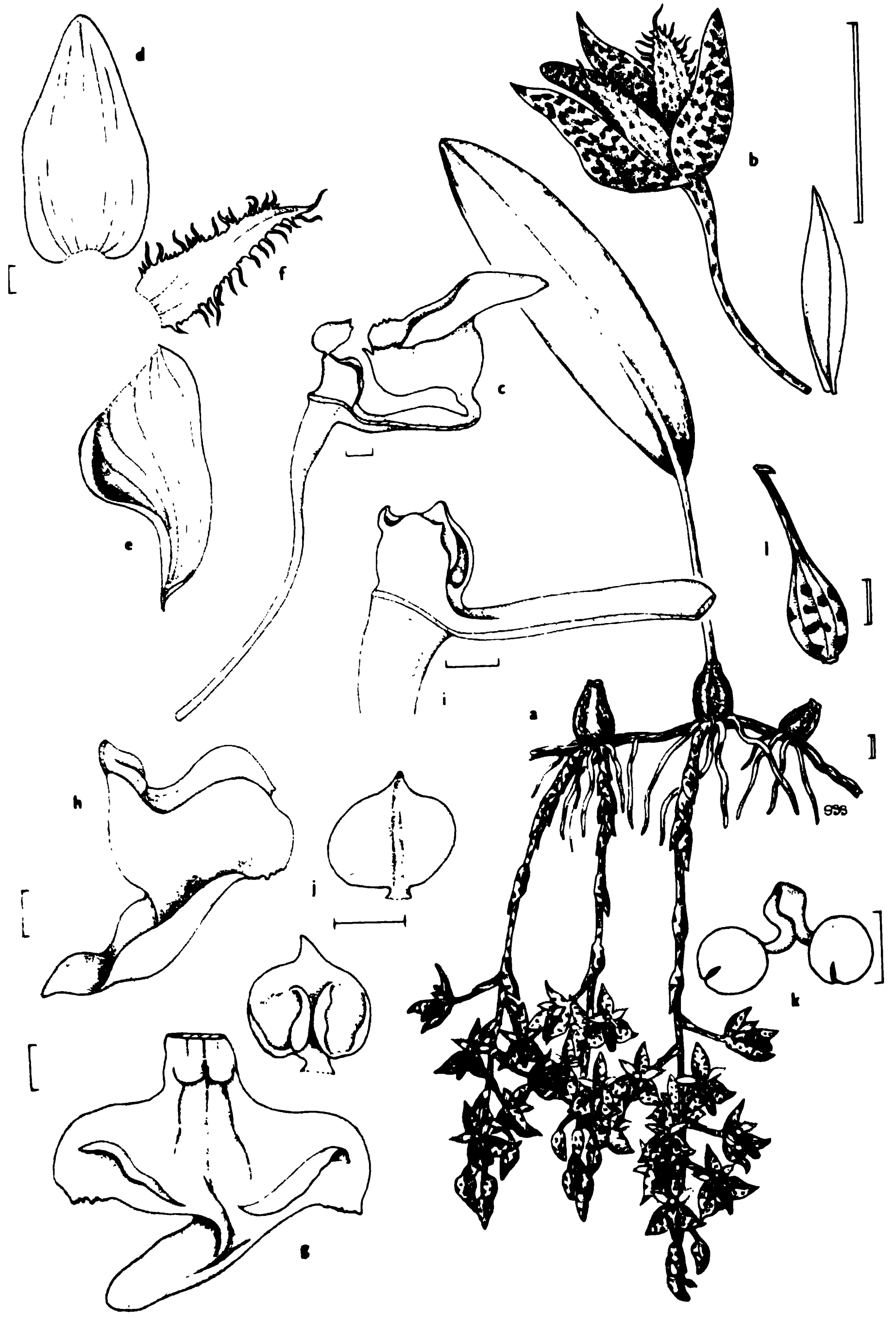

Fig. 99. ***Acrochaene punctata***: a, habit; b, flower with bract; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal, f, petal, g, lip (front view); h, lip (side view), i, column (side view); j, anther cap (two views); k, pollinarium; l, fruit. Drawn by Susanna Stuart-Smith, a–k from *King* s.n. (K); l from *Hooker* 40 (K).

99. Bulbophyllum Thouars

Plants epiphytic or lithophytic, small to large; *rhizome* short to long, creeping to pendent, covered by scarious sheaths. *Pseudobulbs* stout, sessile, often angled, distant or clustered on rhizome. *Leaves* 1 or 2 from pseudobulb apex, thin-textured to coriaceous, erect, suberect, spreading or pendent. *Inflorescence* lateral, arising from pseudobulb base, racemose to capitate, 1- to many-flowered; rachis sometimes flattened. *Flowers* minute to large, occasionally showy. *Dorsal sepal* free; *lateral sepals* connate at base to column foot to form a saccate mentum (sometimes connate above). *Petals* free. *Lip* simple to 3-lobed, sometimes fleshy, often ciliate or pubescent, ± recurved. *Column* short, erect with ± terminal, aristate teeth or wings; anther terminal; pollinia 4, waxy; naked, viscidium or hamular stipe sometimes present.

The genus *Bulbophyllum* was established in 1822 by Albert Aubert du Petit-Thouars (1758–1831) in his *Histoire Particulière des Plantes Orchidées*. The genus comprises about 1000 species widely distributed in the tropical Americas, Africa, Madagascar, the Mascarene Islands, SE Asia to Australasia.

Most species of *Bulbophyllum* are myophilous (fly pollinated), but Johansson (1974) reported pollination by wasps and stingless bees in W Africa. Some flies are attracted to flowers in search of nectar while others (carrion-flies) are attracted by putrid or decaying odours (sapromyophily). Pohl (1935) demonstrated that the SE Asian *B. lobbii* Lindl. has oils and sugars on the lip base that can attract flies and van der Pijl & Dodson (1966) reported that the lip is hinged in such a way as to 'throw' the fly against the column. Jones & Gray (1976) and Jones (1985b) observed the pollination of *B. longiflorum* Thouars and *B. weinthalii* R. Rogers in Australia, and found them to be pollinated respectively by the fly *Silba excisa* and the blowfly *Calliphora tibialis*, which enter the flowers to collect nectar. As the fly walks along the lip it passes the centre of balance thus tilting the lip towards the column; the struggling fly touches the viscidia which contract, cementing the pollinia to the thorax.

TYPE. *Bulbophyllum nutans* (Thouars) Thouars; basionym: *Phyllorchis nutans* Thouars, *typ. cons.*
ETYMOLOGY. From the Greek *bulbo-* (bulb) and *phyllon* (leaf).

Key to species

1. Pseudobulbs with 1 leaf 2

+ Pseudobulbs with 2 leaves 54

2. Inflorescence 1-flowered 3
+ Inflorescence 2- to many-flowered 11

3. Rhizome free, pendent (attached to substrate by roots only) .... **6. B. tortuosum**
+ Rhizome creeping (attached to substrate over most of its length) 4

4. Leaves deciduous; flower less than 1.4cm across or long 5
+ Leaves not deciduous; flower more than 1.8cm across or long 6

5. Column foot not elongate; lateral sepals partly overlapping with petals .... **5. B. otoglossum**
+ Column foot distinctly elongate; lateral sepals inserted on the column foot at a distance from the petals .... **19. B. gymnopus**

6. Dorsal sepal distinctly shorter than the lateral sepals .... **41. B. appendiculatum**
+ Dorsal sepal equalling the lateral sepals 7

7. Pseudobulbs distant along rhizome 8
+ Pseudobulbs clustered on rhizome 9

8. Lip simple, yellow .... **1. B. affine**
+ Lip 3-lobed, red .... **4. B. monanthum**

9. Leaf less than 5cm long; petiole less than 0.5cm long; floral bract less than 0.5cm long **2. B. griffithii**
+ Leaf more than 7.5cm long; petiole more than 2.5cm long; floral bract more than 1cm long 10

10. Pedicel and ovary more than 3cm long; lip with basal auricles; lip surface not tuberculate **3a. B. leopardinum** var. **leopardinum**
+ Pedicel and ovary less than 3cm long; lip lacking basal auricles; lip surface tuberculate **3b. B. leopardinum** var. **tuberculatum**

11. Pseudobulbs very small compared to size of plant 12
+ Pseudobulbs conspicuous compared to size of plant 19

12. Inflorescence very dense, globose or cylindric, many-flowered 13
+ Inflorescence laxly many-flowered, or with only 1 or 2 flowers 16

13. Inflorescence globose 14
+ Inflorescence densely cylindric, racemose 15

14. Plants lacking pseudobulbs; leaves oblanceolate-elliptic; flowers dull purple ... **27. B. gracilipes**
+ Pseudobulbs globose; leaves linear-oblong; flowers red-brown with darker striations **29. B. piluliferum**

15. Rachis with a large sheathing bract at base .... **26. B. cylindraceum**
+ Rachis lacking a sheathing bract at base .... **28. B. khasyanum**

16. Rachis 2-flowered .... **32. B. hymenanthum**
+ Rachis laxly many-flowered 17

17. Plant less than 6.5cm tall; leaves elliptic, less than 3cm long; petiole less than 1.2cm long **25. B. cornu-cervi**
+ Plant more than 18cm tall; leaves ovate-elliptic, more than 8.5cm long; petiole more than 2.5cm long 18

18. Sepals and petals brownish-yellow flushed with green; flowers more than 4mm across; lateral sepals obtuse .... **30. B. rigidum**
+ Sepals and petals pale green; flowers less than 4mm across; lateral sepals acute to acuminate **31. B. apodum**

19. Margins of petals partially or entirely denticulate or ciliate 20
+ Margins of petals glabrous, entire 32

20. Dorsal sepal equalling lateral sepals; inflorescence racemose 21
+ Dorsal sepal significantly shorter than lateral sepals; inflorescence umbellate or subumbellate 25

21. Pseudobulbs cylindric-ovoid, more than 2.5cm tall 22
+ Pseudobulbs turbinate-discoid or sub-conical, less than 1.8cm tall 23

22. Lip shortly glandular-ciliate; sepals and petals green to greenish-white .... **20. B. eublepharum**
+ Lip long fimbriate-echinate; sepals and petals brownish-yellow .... **22. B. penicillium**

23. Inflorescence secund; flowers purple .... **23. B. secundum**
+ Inflorescence not secund; flowers yellowish-white or greenish-white 24

24. Flowers white with a green lip; lateral sepals less than 2.7mm long; pseudobulbs discoid **21. B. parviflorum**
+ Flowers uniformly yellowish-white; lateral sepals more than 3.5mm long; pseudobulbs depressed-obturbinate to subconical .... **24. B. thomsonii**

25. Dorsal sepal long setose or fimbriate 26
+ Dorsal sepal shortly papillose, irregularly dentate-erose or entire 27

26. Lateral sepals more than 5cm long; apex long caudate-acuminate ...... **44. B. rothschildianum**
+ Lateral sepals less than 1cm long; apex acute to subacute .... **45. B. roxburghii**

27. Apex of dorsal sepal long-setose; margins entire .... **39. B. amplifolium**
+ Apex of dorsal sepal not long-setose; margins irregularly erose-dentate or minutely papillose 28

28. Flowers more than 3.5cm across; lateral sepals more than 3.5cm long ... **42. B. emarginatum**
+ Flowers less than 2.5cm across; lateral sepals less than 2cm long 29

29. Scape more than 10cm long 30
+ Scape less than 4cm long 31

30. Dorsal sepal linear; lateral sepals spreading and flat; flowers pink .... **40. B. andersonii**
+ Dorsal sepal not linear; lateral sepals forming a closed tube; flowers yellow with red spots **43. B. helenae**

31. Peduncle filiform, more than 2cm long; flowers to 1.2cm long, pale yellow-ochre **46. B. scabratum**
+ Peduncle stout, less than 1.5cm long; flowers 1.2cm or more long, pale pink on a white base **47. B. yoksunense**

32. Ovary with two long, prominent jugae (filaments) .... **14. B. bisetum**
+ Ovary lacking jugae (filaments) 33

33. Lip with auricles at base 34
+ Lip lacking auricles at base 36

34. Petioles more than 2.5cm long; inflorescence 2- to 4-flowered .... **13. B. striatum**
+ Petioles less than 2cm long; inflorescence cylindric, densely many-flowered 35

35. Peduncle laxly sheathed (except at base); peduncle more than 4cm long; stelidia long **15. B. careyanum**
+ Peduncle with dense, swollen sheaths throughout; peduncle less than 2cm long; stelidia short **16. B. crassipes**

36. Inflorescence racemose 37
+ Inflorescence umbellate to subumbellate 39

37. Inflorescence densely racemose; sepals linear-lanceolate, more than 9mm long **10b. B. odoratissimum var. racemosum**
+ Inflorescence laxly racemose; sepals ovate-oblong, less than 6.5mm long 38

38. Pseudobulbs clustered on rhizome; leaf usually absent during flowering; lip yellow **17. B. polyrhizum**
+ Pseudobulbs distant on rhizome; leaf usually present during flowering; lip yellow with a strong purple margin .... **18. B. reptans**

39. Lateral sepals connivent for at least part of their length 40
+ Lateral sepals free 45

40. Scape shorter than leaves 41
+ Scape equalling or exceeding leaves 42

41. Lateral sepals not forming a flattened, spathulate sac; flowers less than 1cm long **53. B. sarcophylloides**
+ Lateral sepals forming a broad, flattened, spathulate sac; flowers more than 1cm long **55. B. spathulatum**

42. Pseudobulbs discoid, less than 5mm tall .... **54. B. sarcophyllum**
+ Pseudobulbs conical or globose-ovoid 43

43. Dorsal sepal half as long as lateral sepals .... **52. B. rolfei**
+ Dorsal sepal two-thirds to three-quarters length of lateral sepals 44

44. Pseudobulbs globose; lip orange-yellow; scape less than 6cm .... **50. B. muscicola**
+ Pseudobulbs conical; lip deep violet; scape more than 6cm .... **51. B. retusiusculum**

45. Dorsal sepal conspicuously shorter than lateral sepals 46
+ Dorsal sepal about equalling lateral sepals 49

46. Plant less than 4cm tall; inflorescence capitate; peduncle less than 0.2cm long .. **56. B. sterile**
+ Plant more than 10cm tall; inflorescence umbellate; peduncle more than 1.3cm long 47

47. Lateral sepals more than twice as long as dorsal sepal .... **48. B. elatum**
+ Lateral sepals less than twice as long as dorsal sepal 48

48. Inflorescence exceeding leaves; flowers spotted with purple; stelidia long-caudate **49. B. guttulatum**
+ Inflorescence shorter than leaves; flowers not spotted with purple; stelidia short **57. B. umbellatum**

49. Petals 1-veined 50
+ Petals 3-veined 52

50. Inflorescence a dense, many-flowered head .... **10a. B. odoratissimum var. odoratissimum**
+ Inflorescence laxly 3- to 6-flowered 51

51. Inflorescence equalling or exceeding leaves .... **8. B. gamblei**
+ Inflorescence conspicuously shorter than leaves .... **9. B. leptanthum**

52. Pseudobulbs more than 3cm long .... **7. B. cauliflorum var. sikkimense**
+ Pseudobulbs less than 1.5cm long 53

53. Inflorescence 5- to 10-flowered; flowers uniformly golden-yellow .... **11. B. shweliense**
+ Inflorescence 2- or 3-flowered; sepals and petals white with red tips, lip yellow-white **12. B. stenobulbon**

54. Petals with hairs on margins 55
+ Petals glabrous 56

55. Dorsal sepal conspicuously shorter than lateral sepals .... **33. B. wallichii**
+ Dorsal sepal equalling lateral sepals .... **35. B. hirtum**

56. Lateral sepals more than 1.4cm long; inflorescence lax .... **38. B. viridiflorum**
+ Lateral sepals less than 0.7cm long; inflorescence dense 57

57. Leaves absent at flowering; petals broadly triangular; flowers purple .... **37. B. triste**
+ Leaves present at flowering; petals narrowly triangular; flowers yellow or green with orange lip 58

58. Rachis abruptly decurved; lateral sepals connivent from base to apex ...... **34. B. cariniflorum**
+ Rachis not abruptly decurved; lateral sepals connivent at base only .... **36. B. pandingii**

Section **Sestochilus** (Breda) Bentham & Hook. f., Gen. Pl. 3: 502 (1883).

1. **B. affine** Lindl., Gen. Sp. Orchid. Pl.: 48 (1830). Type: Nepal, Sheopore, coll. *Wallich* Wall. Cat. 1982 (holo. K-LINDL!, iso. BM! K-W! K!).
Sarcopodium affine (Lindl.) Lindl. in Paxton's Fl. Gard. 1: 155 (1850), *in obs.*
Phyllorchis affinis (Lindl.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic; *rhizome* creeping, covered by overlapping sheaths; *roots* profuse, filiform, clustered below nodes. *Pseudobulbs* inserted at intervals of 3.5–7.5cm along rhizome, erect, cylindric, rugose, 2.5–4 × 0.3–0.6cm. *Leaf* 1, coriaceous, linear-oblong to narrowly oblong-elliptic, apex obtusely and inconspicuously 2-lobed, 7.5–18 × 2.5–3.5cm; petiole channelled, 0.8–1.3cm long. *Inflorescence* basal, very short, 1-flowered; peduncle slender, enclosed by overlapping sheaths, 2–3cm long; sheaths 3–5, scarious, lanceolate, 5–7mm long; floral bract lanceolate, 7 × 2mm. *Flower* 2–3cm across; sepals and petals cream-coloured to greenish-white with red stripes, lip yellow with distant purple margins; pedicel and ovary slender-filiform, 3–6cm long. *Dorsal sepal* linear-lanceolate, acuminate, weakly concave, 3-veined, 1.3–2 × 0.3–0.4cm; *lateral sepals* obliquely triangular-lanceolate, acute to subacuminate, weakly falcate, 5-veined, 1.4–2.2 × 0.3–0.5cm. *Petals* linear-lanceolate, acuminate, 3-veined, 1.3–1.7 × 0.3–0.4cm. *Lip* simple, fleshy, adnate to base of column foot, ovate to triangular-ovate, acute, decurved towards the base, 7–8mm long. *Column* fleshy, 3-armed, poorly developed, 2.5–3mm long; column foot weakly curved, 4–5mm long. *Fruit* long-stalked, cylindric, 2.5 × 0.4cm; stalk 2cm long. **Plate 24.**

Bhutan: C – Punakha (Lobesa, Punakha Valley (field record), Wangdi Phodrang (field record)) and Mongar (4km E of Mongar Dzong (M.F.B.)) districts; **Sikkim** (Gangtok). On *Quercus lamellosa* and *Schima wallichii*, in tropical valleys; 1000–1800m. Fl. June.

GENERAL DISTRIBUTION. W Himalaya, Nepal, NE India, China, Thailand, Laos, Vietnam and the Ryukyu Islands.
ETYMOLOGY. From the Latin *affinis* (allied to) in reference to its similarity to *B. leopardinum*.

2. **B. griffithii** (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 247 (1861). Types: India, Khasia Hills, *Lobb* s.n. (syn. K-LINDL!); Khasia Hilla, *Hooker & Thomson* 53 (syn. K-LINDL!); Myrung, *Griffith* (syn. K not found).

Dendrobium bolbophylli Griff., Itin. Pl. Khasyah Mts.: 65, no.1019 (1848), nom. nud. Type: Myrung, *Griffith* (cited above).

Bolbophylli sp. Griff., Icon. Pl. Asiat. 3: t.296, f.2 (1851).

Sarcopodium griffithii Lindl., Fol. Orchid. Sarcopodium 2: 6, no.15 (1853).

Phyllorchis bolbophylli (Griff.) Kuntze, Revis Gen. Pl. 2: 676 (1891).

Bulbophyllum calodictyon Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 70 (1919). Type: China, Yunnan, *Henry* 13609 (holo. B).

Plant epiphytic or lithophytic, 6–8cm tall; *roots* clustered along rhizome. *Pseudobulbs* ovoid, compressed, weakly falcate, rugose, close together on rhizome, 1.1–2 × 4–9mm. *Leaf* 1, oblong-lanceolate, erect or deflexed, subacute to obtuse, 2–5.1 × 0.9–1.5cm; petiole straight or twisted, 4–5mm long. *Inflorescence* basal from pseudobulb, 1-flowered; peduncle sheathed at base, glabrous, 1.8cm long; sheath tubular, 1cm long; floral bract ovate-lanceolate, subacute, 5mm long. *Flower* 1.8cm across; sepals and petals yellowish-white with red-brown to pinkish-purple spots, lip white, blotched with pinkish-purple, column white; pedicel and ovary slender, 1.2cm long. *Dorsal sepal* ovate-oblong, acute, 5-veined, 1.2 × 0.6cm; *lateral sepals* ovate, weakly falcate, obtuse, base broad, 0.8–1.4 × 0.6–0.65cm. *Petals* ovate, acute, margins erose, 3-veined, 7–9 × 4–5mm. *Lip* simple, fleshy, oblong, subacute, 6mm long; base with 2 forward-pointing, tooth-like auricles and 2 slender crenate ridges from base to apex. *Column* winged, with 2 acuminate stelidia, 3mm long; wings broadly triangular; foot curved.

Bhutan: C – Tashigang district (near Tashi Yangtsi); **Sikkim** (Lachung (King & Pantling, 1898)). On rocks in river valley; 1930–3000m. Fl. October; Fr. May.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named after William Griffith (1810–1845) who collected plants in Assam with N. Wallich and later in Bhutan.

3. **B. leopardinum** (Wall.) Lindl., Gen. Sp. Orchid. Pl.: 48 (1830). Type: Nepal, Chandaghiry (Kndrang Garhi), coll. *Wallich* Wall. Cat. 1981 (holo. K-LINDL!, iso. K-W! K!).

Dendrobium leopardinum Wall., Tent. Fl. Nepal. 1: 39, t.28 (1826).

Sarcopodium leopardinum (Wall.) Lindl. in Paxton's Fl. Gard. 1: 155 (1850).

Phyllorchis leopardina (Wall.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

3a. var. **leopardinum**

Plant epiphytic; *rhizome* stout, creeping, covered by fibrous sheaths; *roots* clustered, flexuous, slender. 0.2–0.5mm wide. *Pseudobulbs* clustered, cylindric-ovoid to cylindric-obpyriform, ± compressed, smooth or with indistinct, rounded ridges, 2–5 × 0.7–2.5cm. *Leaf* 1, apical, oblong-elliptic, mucronate, coriaceous, rigid, jointed, 7.5–20 × 2.5–6cm; petiole channelled, 2.5–7cm long. *Inflorescence* very short, 1(–3)-flowered; peduncle sheathed at base, 1.4–1.6cm long; floral bracts broadly ovate, acute, 1–1.2 × 0.6–0.7cm. *Flowers* fasciculate, globose-campanulate, 2–3cm across; sepals and petals pale yellowish-brown to greenish, densely spotted with purple, lip deep crimson-purple, column pale yellow; pedicel and ovary slender, 3–4cm long. *Dorsal sepal* ovate-lanceolate, acute, 7-veined, 1.7–2 × 0.65–0.8cm; *lateral sepals* obliquely ovate, acuminate, forming a mentum at base, 7-veined, 1.9–2.3 × 0.9–1cm. *Petals* broadly ovate, acute to acuminate, 5-veined, 1.1–1.5 × 0.5–0.6cm. *Lip* fleshy, ovate-lanceolate, obtuse, entire, decurved, attached to apex of column foot, 1–1.5 × 0.8–1cm; disc with 2 dentate basal auricles and 2 pronounced longitiudinal ridges. *Column* thick, 3–8mm long; foot curved, 1.5–1.6cm long; stelidia stout, triangular, c.1mm long; pollinia 2.5–3mm across. Fruit stalked, cylindric, 3–3.6 × 1.1–1.6cm; stalk 4–5.7cm long.

Bhutan: C – Punakha (E side of Dochu La, between Tashi Choling and Kyebaka) and Tashigang (near Tashi Yangtsi (M.F.B.)) districts; **Sikkim** (Lachen Valley, Tendong). 1400–2300m. Fl. (April–)June–October; Fr. July.

GENERAL DISTRIBUTION. Nepal, NE India and Myanmar.
ETYMOLOGY. Named for the leopard-like spots on its flowers.

3b. var. **tuberculatum** N.P. Balakrishnan & S. Chowdhury in Bull. Bot. Surv. India 9(1–4): 90 (1967). Type: Bhutan, Nyoth, *Balakrishnan* 41971 (holo. CAL, iso. ASSAM).

Differs from var. *leopardinum* as follows: *flowers* 4.5 × 3.5cm; sepals and petals mottled with dark scarlet; pedicel and ovary 2cm long. *Sepals* and *petals* densely, minutely papillose internally. *Lip* ovate, acute, densely tuberculate-papillose on upper surface (lacking toothed auricles at base). *Column* with an acute, beaked hood.

Bhutan: C – Tashigang district (Nyoth, near Tashi Yangtsi). 1800m. Fl. March.

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *tuberculatus* (warty) in reference to the lip surface.

4. **B. monanthum** (Kuntze) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 8: 16 (1912). Types: Bhutan, Devangiri (Deothang), *Griffith* 138 (holo. not found); Lectotype: Mishmee Hills, *Griffith* s.n. (K-LINDL!), designated by Seidenfaden in Nordic J. Bot. 14: 201 (1994).

Bulbophyllum uniflorum Griff., Itin. Pl. Khasyah Mts.: 110 (1848); Not. Pl. Asiat. 3: 293 (1851); Not. Pl. Asiat. 3: t.295 (1851), *nom. illegit.*

Sarcopodium uniflorum (Griff.) Lindl., Fol. Orchid. Sarcopodium 2: 6, no.16 (1853).

Phyllorchis monantha Kuntze, Revis. Gen. Pl. 2: 676 (1891).

Bulbophyllum pteroglossum Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 71 (1919). Type: China, Yunnan, *Henry* 12959 (holo. B).

B. capillipes sensu Seidenfaden & Smitinand, Orchids Thailand: 377 p.p. (1961), *non* Parish & Rchb. f.

B. devangiriense Balakrishan in J. Bombay Nat. Hist. Soc. 67: 66 (1970), *nom. superfl.*

B. tiagii Chauhan in J. Econ. Taxon. Bot. 5(4): 995 (1984), *nom. superfl.*

Plant epiphytic, c.13cm tall; *rhizome* terete, covered in fibrous sheaths, 2–4mm thick; *roots* arising around nodes, clustered, slender, 1.2–4cm long. *Pseudobulbs* cylindric, erect to curved, weakly rugose, narrow, tapering towards apex, inserted at intervals of c.4.5cm along rhizome, fibrous-sheathed at base, 2.5–4.5 × 0.2–0.4cm. *Leaf* 1 from pseudobulb apex, oblong, apex subacute, coriaceous, blade c.9.5 × 1.5cm; petiole c.1.5cm long. *Inflorescence* basal, pendent, 1-flowered; peduncle sheathed at base, c.1cm long. *Flower* c.2cm across; sepals orange, red inside, petals white apically, lip red; pedicel and ovary filiform, c.3.5cm long. *Dorsal sepal* ovate, subacute, 5-veined, c.1.3 × 0.65cm; *lateral sepals* lanceolate, falcate, saccate at base, c.7 × 5mm (at base). *Petals* linear-oblong, obtuse to subacute, 3-veined, c.8 × 2mm. *Lip* 3-lobed, oblong, c.3 × 1.5mm; base shortly clawed, with 2 horn-like curved auricles; lateral lobes suborbicular; mid-lobe lanceolate-triangular, margins entire; disc unadorned. *Column* c.2mm tall; stelidia 2, long; anther cap c.1.5mm across.

Bhutan: S – Deothang district (Deothang).

GENERAL DISTRIBUTION. NE India, China (Yunnan), Thailand and Vietnam.
ETYMOLOGY. From the Greek *mono-* (single) and *anthos* (flower).
NOTES. Seidenfaden (1994a) discussed the confusion between this species and *B. capillipes* Parish & Rchb. f. and the problem of the possibly homonymous *B. monanthos* Ridley. His conclusion was that because *monanthos* 'must be a noun in apposition' while *monanthum* is an adjective they should not be treated as homonyms.

5. **B. otoglossum** Tuyama in Univ. Mus. Univ. Tokyo Bull. 2: 177 (1971). Type: Bhutan, Longtepang to Ritang, *Kanai, Murata, Ohashi, Tanaka & Yamazaki* s.n. (holo. TI!).

Plant epiphytic, 4–6.5cm tall; *rhizome* short, creeping; *roots* borne at nodes, coriaceous, many, slender. *Pseudobulbs* conical, curved, 1.5–2.5 × 0.3–0.4cm. *Leaves* spathulate to linear-spathulate, obtuse to minutely apiculate, 3.2–6.9 × 0.4–1cm; petiole 0.3–0.5cm long. *Inflorescence* very short, basal from pseudobulb, erect, 1-flowered. *Flower* 1.2–1.4cm long; pedicel and ovary 1.7–2cm long. *Sepals* glabrous, minutely brown-spotted; *dorsal sepal* linear-oblong, subacute, concave, 7-veined, c.1.3 × 0.5cm; *lateral sepals* broadly oblique-ovate, obtuse to acute, 5-veined, partly adnate to lip hypochile, c.1.3 × 0.5cm. *Petals* obovate, subacute, 5-veined, denticulate, c.9 × 5mm. *Lip* broadly ovate-hastate, apex obtuse, 5-veined, warty, c.2.5mm long. *Column* obtusely 2-winged, c.4mm long; stelidia 2, minute, unequally 2-lobed.

Bhutan: C – Punakha (between Longtepang and Ritang) and Tongsa (Rukubji to Chendebi) districts. 2300–3200m. Fl. April.

GENERAL DISTRIBUTION. Nepal and China.
ETYMOLOGY. From the Greek *oto-* (ear) and *glossa* (tongue).

Section **Polyblepharon** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 10: 177 (1911) nom. nud.; Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 701, 794 (1913).

6. **B. tortuosum** (Bl.) Lindl., Gen. Sp. Orchid. Pl.: 50 (1830). Type: Java, Salak, Tjiapoes, *Blume* s.n. (holo. L! Herb. no. 905233186, iso. P).
Diphyes tortuosa Bl., Bijdr.: 311 (1825).
Phyllorchis tortuosa (Bl.) Kuntze, Revis. Gen. Pl. 2: 678 (1891).
Bulbophyllum listeri King & Pantling in J. Asiat. Soc. Bengal 64(3): 334, t.2 (1896). Type: India, British Bhutan (Darjeeling), Rumpti Lake, *Pantling* 113 (holo. CAL, iso. AMES! BM! K! W!).

Plant epiphytic, pendent; *rhizome* long, rooting at base, branched, pendent; *roots* filiform to worm-like. *Pseudobulbs* narrowly ovoid, terete, apex annular, lying parallel to rhizome, rugose, sheathed at base, 1.1–1.5 × 2–4mm; sheaths membranous, veined, broadly lanceolate, acuminate, 0.9–1.1cm long. *Leaf* 1, linear-oblong to narrowly lanceolate, acute, shortly petiolate to subsessile, 2.7–4 × 0.3–0.7cm. *Inflorescence* lateral from pseudobulb, 1-flowered; floral bract lanceolate, acuminate. *Flower* appressed to rhizome, 1.5mm across; dorsal sepal white with a purple apex, lateral sepals yellowish-purple with red margins, lip purple, yellow or white; pedicel and ovary sheathed at base, 2–3mm long; sheaths membranous. *Dorsal sepal* ovate-lanceolate to oblong-triangular, obtuse, margins ciliate, spreading, 1.5–2 × 0.2–0.3mm; *lateral sepals* curved over lip, apical margins truncate, inner margins connivent to just below apex, outer margins ciliate, 1.5–2 × 0.25–0.3mm. *Petals* ovate, obtuse, apical margins erose, c.0.3mm long. *Lip* simple, narrowly ovate to oblong-lanceolate, apex obtuse, stipitate, deflexed from base, margins ciliate, upper surface with a thickened central ridge, 0.8–1.25mm long. *Column* c.0.9mm long; stelidia elongate, falcately bent or curved; foot weakly curved, c.1.1mm long.

Darjeeling (E of Jaldhaka River). Fl. March.

GENERAL DISTRIBUTION. NE India, Thailand, Laos, Vietnam, Peninsular Malaysia, Sumatra and Java.
ETYMOLOGY. From the Latin *tortuosus* (bent or twisted) in reference to the stelidia.

Section **Desmosanthes** (Bl.) J.J. Smith in Bull. Jard. Bot. Buitenzorg sér. 2, 13: 34 (1914).

7. **B. cauliflorum** Hook. f., Fl. Brit. India 5(2): 758 (1890); Icon. Pl. 21: t.2036 (1892). Type: India, Khasia Hills, *Griffith* Kew Dist. 5139 (lecto. K!, selected by Pearce *et al.* in Edinb. J. Bot. 58(1): 108 (2001)).

Phyllorchis cauliflorum (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).
Bulbophyllum protractum sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 81, t.111 (1898), *non* Hook. f.

var. **sikkimense** N. Pearce & P.J. Cribb in Edinb. J. Bot. 58(1): 108 (2001). Type: India, Sikkim, Choongthang, *Hooker* 36B (holo. K-LINDL!, iso. K!).

Plant epiphytic; *rhizome* terete, woody, branched, 1.5–3mm thick; *roots* arising from nodes, filiform, clustered. *Pseudobulbs* cylindric to ellipsoid, slightly dilated towards base, obliquely attached to rhizome, 3.1–4.1 × 0.3–0.8cm, inserted at intervals of 6.1–12.1cm along rhizome. *Leaf* 1, oblong-elliptic, obtuse, narrowed at base, 5.7–9.2 × 1.5–2.9cm; petiole channelled, 0.9–1.4cm long. *Inflorescence* basal from pseudobulb and along rhizome, subumbellately 4- or 5-flowered; peduncle slender, glabrous, sheathed at base, 1.2–2.1cm long; sheath tubular, lanceolate, 5–7.7mm long; rachis slender, 2–4mm long; non-floral bract lanceolate, acuminate, 4–4.5 × 1.5–2mm; floral bracts linear-lanceolate, acute to acuminate, entire, 2.5–3 × 0.3–0.5mm. *Flowers* not fragrant, 6–8mm across; sepals and petals green flushed with brown (tips of sepals yellow), lip green-brown; pedicel and ovary slender, 3.5–4.5mm long. *Dorsal sepal* linear-lanceolate, caudate-acuminate, margins entire, 3-veined, spreading, 4–8 × 0.3–0.4mm (at base); *lateral sepals* similar, weakly falcate. *Petals* narrowly lanceolate, acuminate, 1-veined, 2.5–5 × 0.3–0.4mm (at base). *Lip* simple, lanceolate, base truncate, deflexed below the centre, subacute, channelled from base to near apex, margins entire, attached to column foot, 1–1.5 × 0.3–0.5mm. *Column* broad, apex with 2 acuminate stelidia, 0.5mm tall; foot curved, 1–2mm long; stigma large. **Fig. 100.**

Darjeeling (unlocalised *Griffith* specimen); **Sikkim** (Chunthang, Lukrap, Tong). In tropical valleys; 660–2000m. Fl. June–August.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *cauliflorus* (bearing flowers on the stem) and Sikkim, where one of the type specimens was collected.
NOTES. Pearce, Cribb & Renz (2001) proposed var. *sikkimense* for the Sikkimese plants which have single-veined petals. King & Pantling (1898) recorded *B. protractum* Hook. f. from Sikkim but their collection (*Pantling* 230) has been re-identified as *B. cauliflorum* var. *sikkimense* and *B. protractum* does not occur in our area. *B. cauliflorum* is closely related to *B. collettii* King & Pantling from Assam. King & Pantling (1897) stated that *B. collettii* grew in dense masses, was smaller, had different sepals and petals, and that the flowering time differed by two months. However, a Pantling collection at Kew from Shillong gives a flowering time of June (i.e. identical with *B. cauliflorum*). The type material is at CAL and we have not been able to examine it and further collections will have to be made before its status is clarified. *B. cauliflorum* also resembles *B. laxiflorum* (Bl.) Lindl. in its flowers, but that species has clustered pseudobulbs.

8. **B. gamblei** (Hook. f.) Hook f., Fl. Brit. India 6(1): 188 (1890); Icon. Pl. ser.4, 21: t.2039b (1892). Type: India, Darjeeling, Goompahar (Ghumpahar), *Gamble* 783 (holo. K!).
Bulbophyllum leptanthum var. *gamblei* Hook. f., Fl. Brit. India 5(2): 759 (1890).
Phyllorchis gamblei (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic or lithophytic; *rhizome* filiform, sheathless, branched, 0.25mm thick; *roots* arising from nodes, long, wiry-filiform. *Pseudobulbs* narrowly obpyriform to subcylindric, 0.9–1.3 × 0.3–0.5cm, inserted at intervals of 3–7.1cm along rhizome. *Leaf* 1, oblong to oblong-lanceolate, apex obtuse, minutely retuse, narrowed at base, 1.8–4 × 0.7–0.9cm; petiole 2–3mm long. *Inflorescence* erect, umbellate, 3- to 6-flowered; peduncle filiform, sheathed, 1.9–4.1cm long; basal sheaths bladeless, 1–2, tubular, overlapping, 0.8–1.1cm long, upper sheaths 2, lanceolate, distant, 2–4mm long; floral bracts narrowly ovate, acute, 4–5.5 × 0.8–1mm. *Flowers* 1–1.4cm across, uniformly pale yellowish-green;

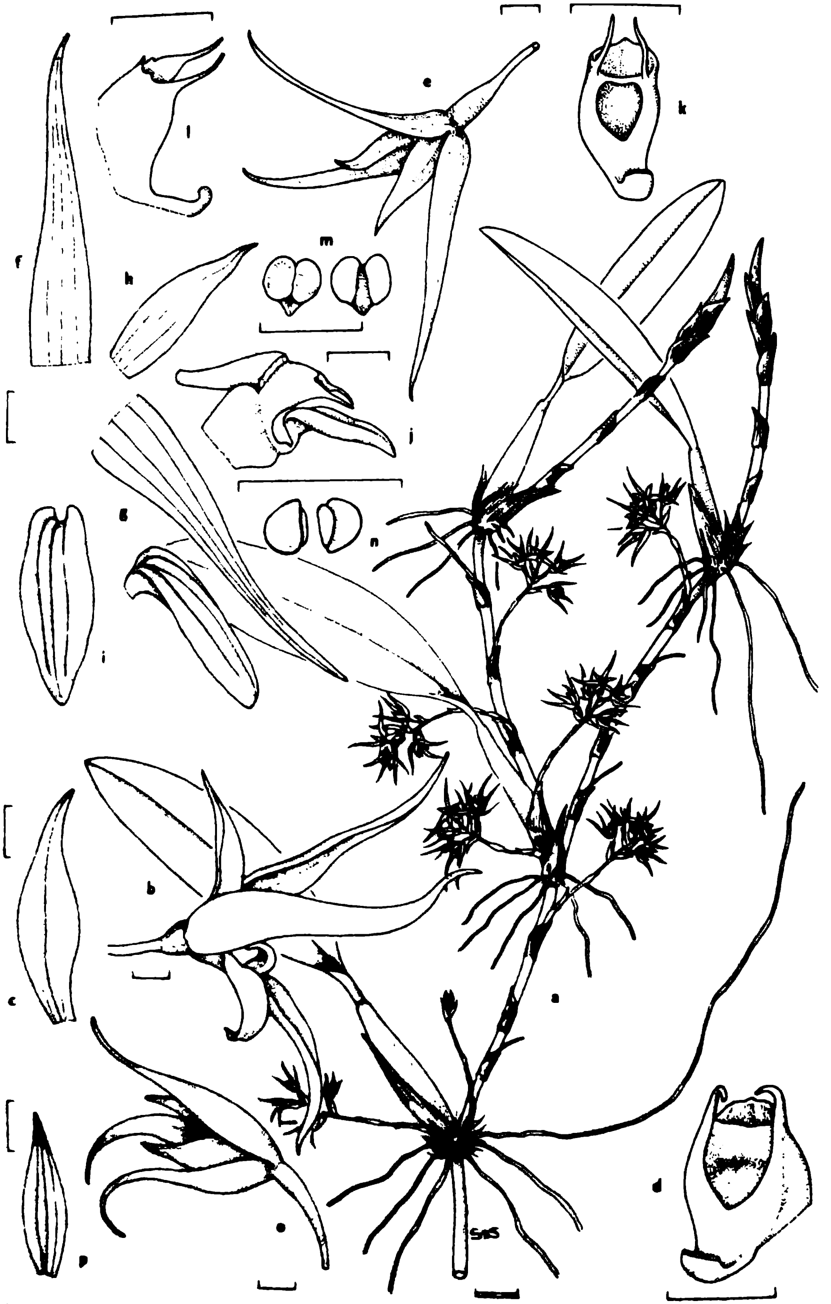

Fig. 108. ***Bulbophyllum cauliflorum* var. *sikkimense***: a, habit; b, flower; c, petal; d, column; e, flower; f, dorsal sepal; g, lateral sepal; h, petal; i, lip (two views); j, column and lip (side view); k, column (front view); l, column (side view); m, pollinarium (two views); n, pollinia. ***B. cauliflorum* var. *cauliflorum***: o, flower; p, petal. Drawn by Susanna Stuart-Smith, a–d from *Hooker* 368 (K); e–n from *Griffith* 5165 (K); o–p from *Griffith* 5139 (K).

pedicel and ovary slender, 3–4mm long. *Dorsal sepal* lanceolate, subcaudate to acuminate, 3-veined, subspreading, 3.8–9 × 1.2–2mm; *lateral sepals* lanceolate, subacute, widened at base, 3-veined, 5.3–9 × 1.7–2mm. *Petals* lanceolate, acuminate, 1-veined, 2–7 × 0.7–2mm. *Lip* simple, adnate to column foot, oblong-lanceolate, subacute, base cordate, grooved centrally, slightly recurved, 2–4 × 0.5–1mm. *Column* broad, 2mm long; stelidia triangular-acuminate; foot curved, 1.5–2mm long.

Bhutan: C – Tashigang district (Tashi Yangtsi, near Lichang); **Duars** (Ghumpahar); **Sikkim** (Damthang to Tendong (F.E.H.2), Rimbi Chhu). On rocks in broad-leaved riverine forest; 1660–2800m. Fl. June–July(–August).

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named after James Sykes Gamble (1847–1925) who was Director of the Forestry School at Dehra Dun between 1890 and 1899 and collected the type specimen.

9. **B. leptanthum** Hook. f., Fl. Brit. India 5(2): 759 (1890); Icon. Pl. ser.4, 21: t.2039a (1892). Types: India, Khasia Hills, *Griffith* s.n. (syn. K-LINDL!); Khasia Hills, *Hooker* 34 (syn. K-LINDL!, isosyn. K!); Khasia Hills, *Hooker* 36A (syn. K-LINDL!, isosyn. K!).

Phyllorchis leptantha (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic; *rhizome* sheathed at nodes, slender, 1.5–2.5mm thick; *roots* arising from nodes, filiform. *Pseudobulbs* cylindric, sheathed at base, 1.3–2.8 × 0.45–0.8cm, inserted at intervals of 2–6cm along rhizome; sheaths tubular, overlapping, mouth wide, 7–9mm long. *Leaf* 1, narrowly oblong, apex obtuse, retuse, base subsessile to shortly petiolate, 4.8–6.9 × 0.9–1.3cm; petiole channelled, 2–3mm long. *Inflorescence* basal, from pseudobulb or from rhizome, erect, umbellate, 3- to 5-flowered; peduncle slender, glabrous, sheathed, 1.8–2.9cm; sheaths 3, lanceolate, acute, 4–5mm long; floral bracts lanceolate, acuminate, 4–5 × 1–1.5mm. *Flowers* 5–7mm across; sepals, petals and lip pale yellowish-green, column with an orange blotch on foot; pedicel and ovary 2–2.5mm long. *Dorsal sepal* spreading, lanceolate, caudate-acuminate, 4–6 × 0.5–0.8mm; *lateral sepals* similar. *Petals* ovate, acute, 1-veined, 2 × 0.5mm. *Lip* simple, ovate-oblong, obtuse, decurved, margins revolute, 2–2.5 × 0.4–0.5mm; base slightly stipitate, grooved. *Column* stout, stelidia small, triangular; lateral wings narrow; foot curved. *Fruit* ovoid, 0.9–1.1 × 0.4–0.45mm.

Sikkim (unlocalised *Pantling* specimen). Fl. July.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Greek *lepto-* (slender) and *anthos* (flower).

10. **B. odoratissimum** (J.E. Smith) Lindl., Gen. Sp. Orchid. Pl.: 55 (1830). Type: Upper Nepal, icon. Buchanan-Hamilton 85 (holo. LINN!).

Stelis odoratissima J.E. Smith in Rees, Cycl. 34: Stelis, no.12 (1814).

S. caudata D. Don, Prodr. Fl. Nepal.: 32 (1825). Type: Nepal, *Wallich* s.n. (holo. BM!).

Tribrachia odoratissima (J.E. Smith) Lindl., Col. Bot. 8: sub t.41 (1826).

Phyllorchis odoratissima (J.E. Smith) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Bulbophyllum congestum Rolfe in Bull. Misc. Inform. Kew 1912: 131 (1912), **syn. nov.** Types: Burma (Myanmar), Kachin Hills, *Mokin* s.n. (syn. K!); SW China, Yunnan, S of Szemao, *Henry* 12291 (syn. E! K!).

B. hyacinthiodorum W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 13: 190 (1921). Type: China, Yunnan, *Forrest* 7987 (holo. E).

10a. var. odoratissimum

Plant epiphytic or lithophytic; *rhizome* creeping, slender, woody, 1–2mm thick; *roots* clustered at nodes, filiform. *Pseudobulbs* erect, cylindric, smooth to ridged, 2–3.5 × 0.3–0.6cm, inserted at intervals of 4.5–7.5cm along rhizome. *Leaf* 1, oblong-elliptic to oblong-lanceolate, apex emarginate, subsessile to shortly petiolate, 6–9 × 1.3–1.9cm; petiole 1–3mm long. *Inflorescence* 1 or 2, basal from pseudobulb, capitate, densely many-flowered; peduncle sheathed, 3.5–8cm long; sheaths imbricate, lanceolate, tubular, 0.5 (at base)-1.8cm long, mouth wide; floral bracts lanceolate, acute to acuminate, concave, 3-veined, 4–8 × 1–2mm. *Flowers* strongly fragrant, 5–7mm across; sepals and petals white tipped with yellow, lip white to pale orange; pedicel and ovary slender, 3–5mm long. *Dorsal sepal* lanceolate, acuminate to subcaudate, 5-veined, 0.25–1 × 0.1–0.15cm; *lateral sepals* spreading, lanceolate, acuminate to subcaudate, falcate, 0.4–1.1 × 0.1–0.15cm. *Petals* spreading, ovate, obtuse, 1-veined, 1–1.5 × 0.5–0.7mm. *Lip* simple, fleshy, oblong-lanceolate, centrally grooved, glandular-pubescent, margins glandular-pubescent, 1.5–1.8 × 0.4–0.7mm. *Column* stout, 0.4–0.6mm tall, stelidia short; foot short; anther papillose. **Plate 25.**

Bhutan: S – Chukka (Raidak Valley) and Gaylegphug (Betini (M.F.B.)) districts; C – Punakha (Kebasa) and Tashigang (near Shali (M.F.B.)) districts; **Darjeeling** (Sureil); **Sikkim** (Rathang Chhu). On mossy rocks, in tropical valleys; 1000–2000m. Fl. May–August.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China, Thailand and Vietnam.
ETYMOLOGY. From the Latin *odoratus* (scented) and the superlative -issimus (the most).
NOTES. Tang & Wang (1951) suggested that B. *congestum* Rolfe and B. *trichocephalum* (Schltr.) T. Tang & F.T. Wang might be conspecific with B. *odoratissimum*. Seidenfaden (1979) treated them as separate species (though with some hesitation) as did Garay, Hamer & Siegerist (1994). We have examined the type material of B. *congestum* and consider it to be indistinguishable from B. *odoratissimum* and therefore reduce it to synonymy here. The type material of B. *trichocephalum* (Yunnan, *Henry* 13086, K!) has long caudate-acuminate sepals and we believe that this species, which does not occur in our area, should be maintained.

10b. var. **racemosum** N.P. Balakrishnan in J. Bombay Nat. Hist. Soc. 75(1): 157, f.2 (1978). Type: E Bhutan, Tashi Yangtsi, *Balakrishnan* 43070 (holo. CAL, iso. ASSAM).

Plant epiphytic; *rhizome* long-creeping, c.2mm thick. *Pseudobulbs* subcylindric, fusiform, c.2 × 1cm, inserted at intervals of 3–4cm along rhizome. *Leaf* 1, coriaceous, elliptic-oblong, subacute to retuse, subsessile to sessile, 5–7 × 1.3–1.7cm. *Inflorescence* basal from pseudobulb, 12–15cm long, racemose, laxly 15- to 20-flowered; peduncle sheathed, green; sheaths 5 or 6, tubular, acute; floral bracts ovate-lanceolate, acute, concave, c.7 × 2mm. *Flowers* scentless, c.2cm across, uniformly white; pedicel and ovary c.1cm long. *Sepals* similar, linear-lanceolate, obtuse, falcate, 0.9–1 × 0.2–0.25cm. *Petals* ovate, acute, c.2 × 1mm. *Lip* simple, adnate to apex of column foot, fleshy, ovate to lanceolate, acute, minutely tuberculate on upper surface, grooved centrally, c.2 × 1mm. *Column* c.2mm long; stelidia 2, mucronate.

Bhutan: C – Mongar (Khoma) and Tashigang (Tashi Yangtsi) districts; **Sikkim** (unlocalised *Gamble* and *Clarke* specimens); **Chumbi** (Song-lee?). 1330–1400m. Fl. July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *racemosus* (racemose).

11. B. shweliense W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 13: 191 (1921). Type: W China, Yunnan, Shweli valley, *Forrest* 18398 (holo. E!, iso. E! K!).
Bulbophyllum craibianum Kerr in Bull. Misc. Inform. Kew 1927: 219 (1927). Type from Thailand.

Plant epiphytic or lithophytic, small; *rhizome* creeping, slender, 0.5–1mm thick; roots from pseudobulb base, filiform. *Pseudobulbs* cylindric to narrowly cylindric, 0.8–1.5 × 0.2–0.5cm, inserted at intervals of 1.5–3cm along rhizome. *Leaf* 1, oblong, apex rounded, retuse, base narrowed, 0.9–3 × 0.3–1cm; petiole 1–2mm long. *Inflorescence* basal from pseudobulb, subumbellate, 5- to 10-flowered; peduncle filiform, sheathed, glabrous, 2.5–3.5cm long; basal sheaths tubular, 5–9mm long, upper ones lanceolate, distant, 3–4mm long; floral bracts lanceolate, acute, concave, membranous, white, 2–4 × 0.5–0.8mm. *Flowers* 6–8mm long, uniformly golden-yellow; pedicel and ovary 1–1.5mm long. *Dorsal sepal* lanceolate, long-acuminate, 3-veined, 5–7 × 1.4–1.6mm; *lateral sepals* lanceolate, acuminate, obtusely falcate, adnate to column foot, 3-veined, base broad, 5–7 × 1.5–2.1mm. *Petals* sub-elliptic, acute, 3-veined, glabrous, 3–3.5 × 1–1.3mm. *Lip* simple, oblong, decurved, margins erect, 2–3mm long. *Column* stout, centrally depressed, 0.8–1mm long; stelidia acute; foot curved at tip, 1–1.5mm long.

Bhutan: C – Tongsa district (between Changkha and Tongsa). 2300–2500m. Fl. June–August.

GENERAL DISTRIBUTION. China (Yunnan) and Thailand.
ETYMOLOGY. From the Shweli Valley, Yunnan Province, China where the type material was collected.

12. **B. stenobulbon** Parish & Rchb. f. in Trans. Linn. Soc. London 30: 153 (1874). Type: Myanmar (Burma), *Parish* 319 (holo. K!).
Bulbophyllum clarkeanum King & Pantling in J. Asiat. Soc. Bengal 64(3): 333 (1896). Type: W Dooar of Bhutan (Darjeeling), Kumai forest, *Pantling* 319 (holo. K!).
B. youngsayeanum S.Y. Hu & Barretto in Chung Chi J. 13(2): 29 (1976). Type: China, Hong Kong, S.Y. Hu 12052 (holo. K!, iso. A CUH US).

Plant epiphytic; *rhizome* long, slender, 1–1.5mm thick. *Pseudobulbs* ovoid-globose, obtuse, 1.2–1.5 × 0.4–0.5cm, inserted at intervals of 2.5–4cm along rhizome. *Leaf* 1, narrowly oblong-elliptic, apex notched, subsessile, 2.7 3.1 × 0.8–1.1cm. *Inflorescence* basal, 2- or 3-flowered; peduncle slender, sheathed at base and towards apex, 2.2cm long; basal sheaths 3, overlapping, lanceolate, 4–6mm long, upper one at base of rachis lanceolate, acuminate, membranous, 5 × 3.5mm long; rachis slender, 7mm long; floral bracts lanceolate, acute, membranous, 4 × 2mm. *Flowers* 5mm across; sepals and petals white, tinged with orange-red at tips, lip yellow to yellowish-white; pedicel and ovary slender, 3.5–4mm long. *Dorsal sepal* lanceolate, acuminate, apex thickened, 3-veined, 5 × 2mm (at base); *lateral sepals* similar. *Petals* broadly ovate, obtuse, 3-veined, 3–4 × 1–1.5mm. *Lip* simple, ovate, acute, decurved, margins erose, 4mm long; upper surface convex with an elongate central pit. *Column* with long projecting spurs, 2–3mm long.

Duars (Kumai Forest). 500m. Fl. June.

GENERAL DISTRIBUTION. NE India, Myanmar and China.
ETYMOLOGY. From the Greek *steno-* (narrow) and *bulbos* (bulb).
NOTES. King & Pantling considered *B. clarkeanum* to differ from *B. stenobulbon* in its pseudobulbs and leaves, but Seidenfaden (1979) thought that they might be conspecific. Tsi (1999) treated these species as conspecific and, although the type material of *B. clarkeanum* is poor, we feel that this treatment is probably correct.

Section **Striata** J.J. Vermeulen in Edinb. J. Bot. 58(1): 121 (2001).

13. **B. striatum** (Griff.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 257 (1861). Type: India, Assam, Mumbree, *Griffith* 236/146 (holo. K-LINDL!).
Dendrobium striatum Griff., Not. Pl. Asiat. 3: 318 (1851).
Sarcopodium striatum (Griff.) Lindl., Fol. Orchid. Sarcopodium 2: 5, no.12 (1853).
Phyllorchis striata (Griff.) Kuntze, Revis. Gen. Pl. 2: 678 (1891).
Bulbophyllum striatitepalum Seidenfaden in Nordic J. Bot. 2(3): 195 (1982). Type from Thailand.

Plant epiphytic, 10–13cm tall; *rhizome* woody, slender; roots arising from nodes, worm-like. *Pseudobulbs* obpyriform to ovoid, rugose, inserted at intervals of 2–6cm along rhizome, purple, 0.9–1.3 × 1–1.5cm (tall). *Leaf* 1, from pseudobulb apex, coriaceous, elliptic, apex retuse, many-veined, green, purple blotched below, 3.8–8 × 1.5–2.9cm (blade); petiole 2.5–4cm long. *Inflorescence* shorter than leaves, subumbellate to shortly racemose, erect, strongly recurved at base, arising from pseudobulb base or nodes of rhizome, 2- to 4-flowered; peduncle slender, sheathed, 5–8cm long; basal sheaths tubular, 5–6mm long, upper ones distant, lanceolate, acute, 4–5 × 1.5–2mm; rachis 0.5–1cm long; floral bracts linear, acute, 2.5–3 × 0.4–0.6mm. *Flowers* 1–1.5cm across; sepals and petals greenish-yellow with deep red-purple striations, lip green with purple veins and reticulations; pedicel and ovary slender, glabrous, erect, 0.8–1.1cm long. *Sepals* subequal, broadly lanceolate, subacute, 5-veined, spreading, 0.7–1 × 0.25–0.4cm. *Petals* lanceolate, subacute, 3-veined (the central strongest), 4–6 × 1.5–2mm. *Lip* ovate-lanceolate, strongly recurved at base, simple, 7–8 × 2–3mm, base with 2 small, oblong, erect, auriculate lobules. *Column* slender, strongly curved, c.3mm long; foot c.4mm long. *Fruit* ovoid-obovoid, long-stalked, 1.5–1.6 × 0.6–0.7cm; stalk 1–1.5cm long.

Bhutan: C – Punakha (Talo) and Tashigang (near Tashi Yangtsi (M.F.B.)); **N** – Upper Pho Chu district (Kewa Nang); **Sikkim** (unlocalised *Pantling* specimen). 2000–2330m. Fl. October–November.

GENERAL DISTRIBUTION. Nepal and NE India.

ETYMOLOGY. From the Latin *striatus* (striped) in reference to the flowers.

NOTES. Seidenfaden (1982) was unsure as to which section his *B. striatitepalum* belonged. It has features of both sections *Desmosanthes* and *Racemosae*. In 1995 he reduced it to the synonymy of *B. striatum*.

Section **Biseta** J.J. Vermeulen in Edinb. J. Bot. 58(1): 120 (2001).

14. B. bisetum Lindl. in Ann. Mag. Nat. Hist. 10: 186 (1842). Type: India, Khasia, *Griffith* s.n. (holo. K-LINDL!).

Bulbophyllum cirrhopetaloides Griff., Not. Pl. Asiat. 3: 290 (1851). Type: India, Khasia, Churra, *Griffith* 169 (holo. K!).

Phyllorchis biseta (Lindl.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic, 7–10cm tall; *rhizome* slender, branched, sheathed, 1–1.5mm wide; sheaths tubular, fibrous, 1–1.5cm long; *roots* arising from pseudobulb, slender, caespitose. *Pseudobulbs* ovoid or conical to flask-shaped, fibrous sheathed at base, 1–2.8 × 0.5–1.1cm, inserted at intervals of 1.8–6cm along rhizome. *Leaf* 1, oblong-lanceolate, acute to acuminate, obliquely 2-lobed, 5.5–9.5 × 1–2cm; petiole channelled, 0.7–1.1cm long. *Inflorescence* basal from pseudobulb, pendent, racemose, subdensely 10- to 20-flowered; peduncle filiform, sheathed, glabrous, 3–7cm; sheaths distant, tubular, 6–9mm long, mouth wide; rachis thicker than peduncle, glabrous, 2–3.5cm long; floral bracts ovate, acute, 2–3.5 × 1–1.5mm. *Flowers* 5–7mm across; sepals dull purple with green-yellow margins, petals pale purple with darker tips and yellowish base, lip purple with a yellowish-white apex, column greenish-yellow; pedicel and ovary slender, 2–3mm long, with two jugae; *jugae* of ovary obliquely filiform, 4–4.2 × 0.25–0.4mm. *Dorsal sepal* ovate-lanceolate, acute, keeled, margins undulate, 4–5 × 1–2mm; *lateral sepals* lanceolate, curved and acuminate, unequal, base connivent for about half length, outer margins undulate, 5–6 × 1–1.5mm. *Petals* spathulate, clawed, acute, 1-veined, 3.4–3.6 × 1.2–1.5mm. *Lip* simple, ovate-lanceolate, stipitate, deflexed centrally, 3–4.3mm long; hypochile with 2 crenate ridges; epichile pubescent, unridged. *Column* with a callus under the stigma, c.1mm long; stelidia 2, linear, 1.4–1.6mm long; foot curved, 1.8–2mm long; anther cap glandular-pubescent. **Plate 24.**

Darjeeling (unlocalised *Gamble* specimen); **Sikkim** (5km NW of Gangtok, Rimbi Chhu). In dense grazed forest; 1000–1900m. Fl. July–October.

GENERAL DISTRIBUTION. NE India and Thailand.

ETYMOLOGY. From the Latin *bi-* (two) and *seta* (a bristle) in reference to the jugae.

NOTE. This species is easily distinguished by the two petal-like jugae of the ovary.

Section **Careyana** Pfitzer, Nat. Pflanzenfam 2(4–6): 179 (1888).

We follow Vermeulen (pers. comm.) and Seidenfaden (1992) who divided section *Racemosae* Bentham & Hook. f., Gen. Pl. 3: 502 (1883) into sections *Careyana* and *Reptantia*.

15. **B. careyanum** (Hook.) Sprengel, Syst. Veg. ed.16(3): 732 (1826). Type: Nepal, *Carey*, cult. Botanic Garden Liverpool, Shepherd (holo. probably lost); Lectotype: Nepal, Thoka, coll. *Wallich* Wall. Cat. 1990.1 (K-LINDL!, iso. K-W!), designated by Seidenfaden in Dansk Bot. Ark. 33(3): 147 (1979).
Anisopetalon careyanum Hook., Exot. Fl. 2: t.149 (1825).
Pleurothallis purpurea D. Don, Prod. Fl. Nepal.: 33 (1825). Type: Nepal, *Wallich* s.n. (holo. BM, not found).
Tribrachia purpurea (D. Don) Lindl., Coll. Bot.: sub t.41a (1826).
Bulbophyllum cupreum sensu Hook. in Bot. Mag. 88: t.5316 (1862), non Lindl.
B. careyanum var. *ochraceum* Hook. f., Fl. Brit. India 5(2): 760 (1890), **syn. nov.** Type: Myanmar (Burma), Aracan, icon. Hooker s.n. (holo. K!).
Phyllorchis purpurea (D. Don) Kuntze, Revis. Gen. Pl. 2: 676 (1891).

Plant epiphytic; *rhizome* stout, 2.5–4mm thick; *roots* arising from nodes, slender, densely clustered. *Pseudobulbs* globose-ovoid to narrowly ovoid, lightly grooved, 1.5–5 × 1.5–2.5cm, inserted at intervals of 3.6–9.5cm along rhizome. *Leaf* 1, erect to suberect,oblong to linear-oblong, obtuse, sessile to shortly petiolate, 7.1–25 × 1.8–5cm; petiole 1–9mm long. *Inflorescence* lateral from pseudobulb base, decurved, racemose, cylindric, densely many-flowered; peduncle stout, sheathed, 4.5–7cm long; sheaths 5, overlapping at base and distant above, broadly lanceolate, acute, 1.2–2.3 × 0.6–1.2cm; rachis glabrous, 3–7.5cm; floral bracts ovate-lanceolate, acute, 5–7 × 1.5–2mm. *Flowers* densely overlapping, 6–8mm long; sepals and petals orange-yellow to greenish, spotted or suffused with red-brown or purple, lip yellow blotched with violet, column orange-yellow; pedicel and ovary stout, 4mm long. *Dorsal sepal* oblong-ovate, acute, 4.5–5 × 2–2.5mm; *lateral sepals* oblong-ovate, acute, 6–8 × 2–2.5mm. *Petals* small, broadly ovate, aristate, margins minutely setaceous to glabrous, 1-veined, 2.5–3 × 0.4–0.5mm. *Lip* simple, auriculate at base, subentire, shortly stipitate, recurved, 3.5–5 × 1.5–2mm. *Column* 1.3–1.6mm tall; stelidia long-aristate, base broad. *Fruit* ovoid, 1–1.3 × 0.5–0.7cm. **Plate 24.**

Bhutan: S – Samchi (Dorkha (M.F.B.)) and Sankosh (Balu Khola) districts; **Terai** (Dalkajhar); **Darjeeling** (10km N of Siliguri); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). In dense forest with *Pandanus*, in deciduous subtropical forest on river bank; 200–1500m. Fl. October–March.

GENERAL DISTRIBUTION. W Himalaya, Nepal, NE India, Myanmar, Thailand and Vietnam.
ETYMOLOGY. Named in honour of the Rev William Carey (1761–1834) who was a Baptist missionary in India and a friend of William Roxburgh.
NOTES. Seidenfaden (1979) discussed the problems with the type material and the lectotype cited above. The type material of *B. careyanum* var. *ochraceum* is probably a drawing made at Kew by Joseph Hooker in 1889 and is indistinguishable from *B. careyanum*.

16. **B. crassipes** Hook. f., Fl. Brit. India 5(2): 760 (1890). Types: India, Sikkim Terai, Dulkajhar, *Clarke* 36904 (syn. K!); Burma (Myanmar), Martaban, *Wallich* 1990.2 (syn. K!, isosyn. K-W!); Burma (Myanmar), Aracan, icon. Hooker s.n. (syn. K!); Malaysia, Penang, *Kerr* s.n. (syn. K-LINDL, not found).
Bulbophyllum careyanum sensu Hook. in Bot. Mag. 71: t.4166 (1845), non (Hook.) Sprengel.
Phyllorchis crassipes (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).
Bulbophyllum careyanum var. *crassipes* (Hook. f.) Pradhan, Indian Orch.: Guide Identif. Cult. 2: 713 (1979).

Plant epiphytic; *rhizome* creeping, robust, 4–5mm thick; *roots* arising from nodes, slender, clustered, 1mm thick. *Pseudobulbs* conical, covered by swollen sheaths, 4–5 × 1–2cm, inserted at intervals of 4–13cm along rhizome. *Leaf* 1, oblong, obtuse to shortly mucronate, tapered at base, thickly coriaceous, 6–14 × 1.5–3.5cm; petiole 1–1.5cm long. *Inflorescence* lateral from pseudobulb base, racemose, stout, densely many-flowered; peduncle thick, short, covered by swollen sheaths, 1.5–2 × 0.3–0.6cm;

sheaths overlapping, tubular, 0.7–1.2cm long, mouth wide; rachis 4cm long; floral bracts oblong, obtuse, 4–6 × 1.2–1.6mm. *Flowers* 4–6mm long; sepals greenish to golden, spotted with purple, petals whitish with purple markings, lip yellowish-gold or purplish-red, column white; pedicel and ovary slender, 3–4mm long. *Dorsal sepal* obovate to elliptic, apex acute, 5–5.5 × 2.6–3mm; *lateral sepals* ovate, acuminate, oblique, margins glabrous, 5–7.5 × 3–4mm; *mentum* 2mm long. *Petals* narrowly elliptic, acute to aristate, 1-veined, 1.5–3 × 0.5–1mm. *Lip* simple to obscurely 3-lobed (lateral lobes very small), oblong, grooved above, margins entire, 2.5–3 × 2–2.5mm. *Column* slender, 2.5–3mm tall; stelidia short, triangular. **Plate 24.**

Bhutan: – (Unlocalised *Grierson & Long* specimen); **Terai** (Dalkajhar). 200m. Fl. September–October.

GENERAL DISTRIBUTION. NE India, Myanmar, Thailand and Malaysia (Penang?).

ETYMOLOGY. From the Latin *crassus* (thick) and *pes* (foot) in reference to the peduncle.

NOTES. *B. crassipes* is closely related to *B. careyanum* but differs in having a short peduncle completely clothed with swollen sheaths, and in possessing an elongate column with short, erect horns. Pradhan (1979) reduced the species to varietal status within *B. careyanum* but we feel that it merits specific rank.

Section **Reptantia** J.J. Vermeulen in Edinb. J. Bot. 58(1): 121 (2001).

17. **B. polyrhizum** Lindl., Gen. Sp. Orchid. Pl.: 53 (1830). Type: India, icon. Wallich s.n. (holo. K!).

Phyllorchis polyrhiza (Lindl.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic or lithophytic, 3–7cm tall; *rhizome* branched, filiform, sheathless, c.1mm thick; *roots* arising from pseudobulb, filiform. *Pseudobulbs* globose-ovoid, green, base broad, 0.4–1.4 × 0.5–1.5cm, inserted at intervals of 4–9mm along rhizome. *Leaf* 1, absent at flowering, narrowly oblong, subacute, sessile, 4–5 × 0.6–0.9cm. *Inflorescence* racemose, secund, laxly 5- to 8-flowered; peduncle suberect, filiform, glabrous, sheathed, 1.8–5cm long; sheaths lanceolate, acute, 1-veined, 2.5–3 × 0.9–1.1mm; rachis recurved, glabrous, 1–8cm long; floral bracts oblong, acute, 1–1.5 × 0.5–0.8mm. *Flowers* 5–8mm long; sepals and petals yellowish-green, lip yellow; pedicel and ovary base hooked, slender, widening upwards, 1–2.5mm long. *Dorsal sepal* ovate-lanceolate, subacute, concave, 3-veined, 4–5 × 2–2.2mm; *lateral sepals* spreading, oblong-lanceolate, subacute, 3-veined, adnate at base, 5–7 × 1.6–2mm. *Petals* broadly ovate, acute, 1-veined, 2–2.2 × 0.8–1.2mm. *Lip* simple, oblong, obtuse, scabrous, deflexed from the base, stipitate, base grooved, 3.5–4 × 0.8–1.2mm. *Column* 1–1.2mm long; stelidia short, acute; foot curved, c.2mm long; anther cap papillose. *Fruit* globose, 4–5 × 2–2.5mm, stalk hooked.

Sikkim (Tista Valley). In subtropical montane, mixed deciduous forest, montane sal (*Shorea robusta*) forest; 1000–1500m. Fl. March–May.

GENERAL DISTRIBUTION. NW India, Nepal, NE India and Myanmar.

ETYMOLOGY. From the Greek *poly-* (many) and *rhiza* (root) in reference to the rhizome.

18. **B. reptans** (Lindl.) Lindl., Gen. Sp. Orchid. Pl.: 51 (1830). Type: Nepal, E. *Rudge* s.n. (holo. K-LINDL!).

Stelis racemosa J.E. Smith in Rees, Cycl. 34: Stelis no.10 (1819). Type: Nepal, icon. Buchanan-Hamilton (holo. LINN!, iso. British Library (India Office)!).

Tribrachia reptans Lindl., Collect. Bot.: t.41a (1826).

Bulbophyllum grandiflorum Griff., Itin. Pl. Khasyah Mts.: 146, no.705 (1848); Not. Pl. Asiat. 3: 293 (1851); Icon. Pl. Asiat. 3: t.294 (1851). Type: Bhutan, Griffith 31 (holo. K-LINDL!).

B. clarkei Rchb. f. in Flora 71: 155 (1888). Type: India, Kohima, *Clarke* 41813 (holo. K!).

B. reptans var. *subracemosum* Hook. f., Fl. Brit. India 5(2): 769 (1890), **syn. nov.** Types: India, Khasia, *Griffith* 5130 (syn. K!, isosyn. W!); Bhutan, Passuling, *Griffith* 31 (syn. K-LINDL!).

Phyllorchis reptans (Lindl.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).
Sunipia racemosa (J.E. Smith) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 90 (1951).
Ione racemosa (J.E. Smith) Seidenfaden in Bot. Tidsskr. 64: 227 (1969).

Plant epiphytic or lithophytic, 9–10.5cm tall; *rhizome* slender, wiry, sheathless, 1–2mm thick; *roots* from pseudobulb base, filifrom. *Pseudobulbs* obpyriform, flattened, 1.3–2 × 1.2–1.6cm, inserted at intervals of 4–6.5cm along rhizome. *Leaf* 1, linear-oblong, subacute, obliquely notched, 7–14.5 × 0.6–1.1cm; petiole 5mm long. *Inflorescence* 1 or 2, basal from pseudobulb, shorter than leaves, racemose, laxly few-flowered; peduncle filiform, decurved, sheathed, glabrous, 1.2–7.5cm long; sheaths lanceolate, subacute, 5–6mm long; rachis filiform, glabrous, 2–9.5cm long; floral bracts oblong-lanceolate, subacute, 2–7 × 1–1.5mm. *Flowers* 0.8–1cm long; sepals and petals yellowish-green with purple spots or streaks, lip yellowish-green with a red margin; pedicel and ovary glabrous, 3–3.5mm long. *Dorsal sepal* ovate-oblong, 3-veined, subacute, margins undulate, 6–6.5 × 1.5–2mm; *lateral sepals* lanceolate, acute, weakly falcate, adnate to column foot, 3-veined, base broad, 7–8 × 2–3mm. *Petals* oblong, obtuse, 1-veined, 2.5–3 × 1–1.3mm. *Lip* simple, stipitate, deflexed centrally, apex narrowed, margins narrowly winged, expanded and grooved at base, 3–4 × 1–1.5mm. *Column* c.1mm long, with 2 triangular projecting wings; stelidia filiform; foot curved, 2mm long. *Fruit* obovoid, ridged, long-stalked, c.6 × 2mm; stalk 5mm. **Fig. 101.**

Bhutan: S – Deothang district (Narfong (M.F.B.)); **C** – Tongsa (2km S of Shemgang), Tashigang (near Lichan, Tashi Yangtsi) and Sakden (between Takhtoo and Phongmi) districts; **Darjeeling** (Sureil); **Sikkim** (Bakhim, Kalej Khola, Lusing). On *Rhododendron arboreum*, in evergreen *Quercus lamellosa* forest, on mossy rocks in open sunlight; 1500–2200m. Fl. October–May.

GENERAL DISTRIBUTION. W Himalaya, Nepal, NE India, Myanmar, China, Thailand and Vietnam.
ETYMOLOGY. From the Latin *reptans* (creeping, prostrate) in reference to the habit.
NOTES. Hooker (1890) established var. *subracemosum* primarily on its 'shorter, oblong, obtuse' floral bracts and based on Griffith collections. We have examined these and find that the collection from Khasia (*Griffith* 5130) has obtuse to subacute floral bracts of 2–4.5mm, and in the Bhutanese collection (*Griffith* 31) they are subacute to acute and 4–5mm long. Amongst the specimens examined this character is very variable and since we cannot separate them into two distinct groups, we do not feel that varietal status is justified. Garay, Hamer & Siegerist (1994) discussed the confusion over *Sunipia racemosa* (J.E.Smith) T. Tang & F.T. Wang, a species based on a Nepalese collection of Buchanan-Hamilton now considered to be a *Bulbophyllum*. The epithet cannot be transferred as there is already *B. racemosum* Rolfe, a plant from Borneo, and the next available name is *B. reptans*.

Section **Henosis** (Hook. f.) Ormerod in Edinb. J. Bot. 58(1): 120 (2001).

19. B. gymnopus Hook. f., Fl. Brit. India 5(2): 764 (1890); Icon. Pl. 21: t.2040 (1892). Types: Bhutan, Dewangiri (Deothang), *Griffith* 65 (syn. K-LINDL!); Bhutan, *Griffith* 5133 (syn. K!); India, Khasia Hills, *Griffith* 5134 (syn. K!, isosyn. W!); India, Khasia, Jowye, *Clarke* 42549 (syn. K!).
Bulbophyllum sp. Griff., Itin. Pl. Khasyah Mts.: 104, no.65 (1848); Not. Pl. Asiat. 3: 294 (1851); Icon. Pl. Asiat. 3: t.297 (1851). Type: Bhutan, *Griffith* 65 cited above.
Phyllorchis gymnopus (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).
Drymoda gymnopus (Hook. f.) Garay, Hamer & Siegerist in Nordic. J. Bot. 14(6): 641 (1994).

Plant epiphytic; *rhizome* long, woody, terete, 2.5–3.5mm thick, leading section covered by overlapping sheaths; sheaths tubular, spotted, 1–1.5cm long; roots clustered at nodes. *Pseudobulbs* ovoid-cylindric, surface smooth, sheathed, 2–3.5 × 0.6–1cm, inserted at intervals of 3–9cm along rhizome; sheaths scarious, 2–3.5cm long. *Leaf* 1, linear-oblong to oblong, apex emarginate, base jointed, 8–17 × 0.8–2.6cm; petiole channelled, 1.6–2.5cm long. *Inflorescences* 2 or 3, basal from pseudobulb, erect,

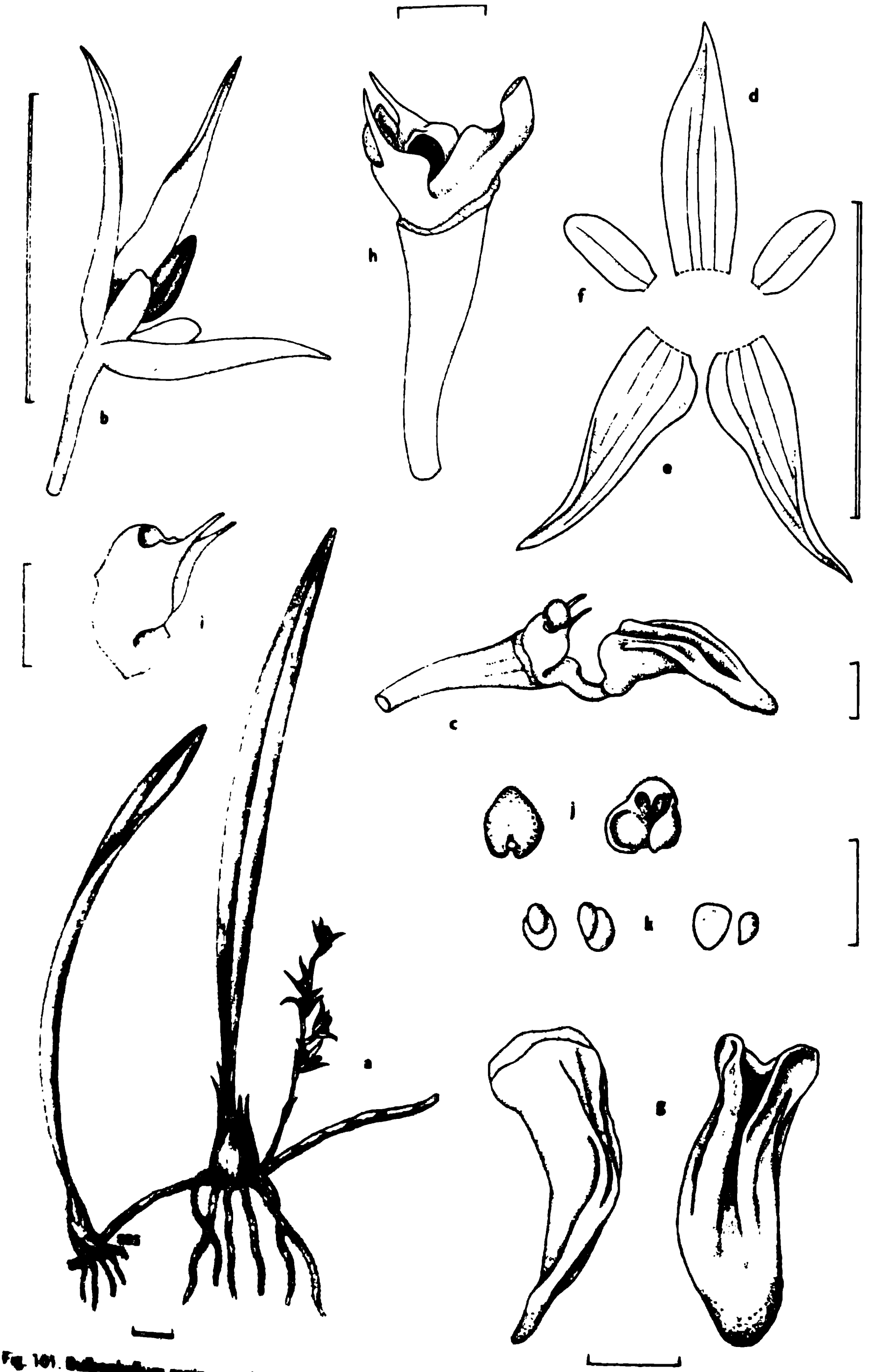

Fig. 101. **Bulbophyllum reptans**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepals; f, petals; g, lip (two views); h, column and ovary; i, column (side view); j, anther (two views); k, pollinia. Drawn by Susanna Stuart-Smith from Grierson & Long 4362 (K).

racemose, laxly many-flowered; peduncle slender, glabrous, sheathed at base, 2–6cm long; sheaths 3, overlapping, 4–8mm long; rachis long, glabrous, 3.5–14cm long; floral bracts lanceolate, acute, 2–3 × 0.8–1mm. *Flowers* 0.8–1cm across; sepals and petals white, spotted with red externally, lip yellow, column pale yellow-ochre, spotted with red; pedicel and ovary slender, glabrous, 0.6–1.5cm long. *Dorsal sepal* lanceolate, acute, concave, 1-veined, 3.5–4 × 1–1.2mm; *lateral sepals* lanceolate, falcate, subacute, 3-veined, inserted on apex of the column foot, margins incurved, 5–7.5 × 1.2–1.5mm. *Petals* linear-lanceolate, obtuse-truncate, 1-veined, margins serrate, 2–2.5 × 0.6–0.8mm. *Lip* simple, lanceolate, acute, 2.5 × 0.6mm. *Column* broad, 1.8–2mm long; stelidia acute, 0.2–0.3mm long; foot slender, strongly curved, 1.8–2mm long; anther cap papillose.

Bhutan: S – Deothang district (Deothang); C – Punakha district (Pho Chu, Samadingkha); **Sikkim** (Engo?). Growing on *Mangifera indica*; 600–1200m. Fl. December–January.

GENERAL DISTRIBUTION. NE India, Myanmar and Thailand.
ETYMOLOGY. From the Greek *gymno-* (naked) and *-pus* (footed) in reference to the column.
NOTES. Seidenfaden (1979) included this species in section *Racemosae* but the attachment of the lateral sepals to the apex of the column foot is characteristic and places it near *B. longipes* Rchb. f. Hooker (1890) transferred *B. longipes* to the new genus *Henosis* but recognized that it was closely related to *B. gymnopus* and to *B. wrayii* Hook.f. Garay, Hamer & Siegerist (1994) transferred *B. gymnopus* to *Drymoda* (a treatment followed by Seidenfaden, 1995) and transferred *B. longipes* to *Monomeria*. Ormerod (pers.comm.) proposed a sectional treatment within *Bulbophyllum* for these distinct species which Vermeulen (pers. comm.) supports and which we follow here.

Section **Hirtula** Ridley, Mat. Fl. Malay. Penins. 1: 59 (1907).

20. **B. eublepharum** Rchb. f. in Walpers, Ann. Bot. Syst. 6: 252 (1861). Type: India, Darjeeling, Griffith s.n. (holo. K-LINDL!).
Phyllorchis eublepharum (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic; *rhizome* absent; *roots* clustered from pseudobulb base. *Pseudobulbs* clustered, cylindric, widened slightly towards base, sheathed, 2.5–7 × 0.4–0.9cm; sheaths overlapping, lanceolate, acute, 1.8–2.5cm long. *Leaf* 1, oblong-elliptic to lanceolate, acute, narrowed to shortly petiolate or subsessile base, 8.5–15.5 × 1.9–3cm; petiole channelled, 0.8–1.8cm long. *Inflorescence* basal from pseudobulb, tall, slender, racemose, laxly 10- to 20-flowered; peduncle glabrous, sheathed at intervals, slender, 12.5–27 × 0.1–0.15cm; sheaths clasping at base, spreading above, lanceolate, subacute, 0.9–2.1cm long; rachis glabrous, 6.5–7.5cm long; floral bracts linear-lanceolate, acute, 5–6 × 0.8–1.2mm. *Flowers* 5–6mm across; sepals green with purple striations, petals greenish-white, lip deep purple, column white; pedicel and ovary glabrous, 3–4mm long. *Dorsal sepal* ovate-lanceolate, acuminate to subcaudate, concave, 6–7 × 2–2.5mm; *lateral sepals* ovate-lanceolate, acuminate, spreading, 3-veined, 8–9 × 1.5–2.5mm. *Petals* ovate-elliptic, 1-veined, subacute, margins serrate-fimbriate, 2–3.5 × 1.5–2mm. *Lip* simple, attached to the column foot, thick, oblong-lanceolate, apex obtuse, emarginate, upper surface deeply grooved, apical margins glandular-ciliate, 2–3 × 1–1.5mm. *Column* broad, 1.5mm long; foot curved, 1.5mm long; stelidia 2, long-linear; anther cap hooded. *Fruit* ovoid, 1.1–1.7 × 0.6–0.8cm.

Bhutan: S – Deothang district (Wamrong (M.F.B.)); C – Tashigang district (Tashigang (M.F.B.)); **Darjeeling** (7km S of Darjeeling); **Sikkim** (Tendong). In open montane forest; 2000–2500m. Fl. July–September(–November); Fr. August.

GENERAL DISTRIBUTION. NE India and Myanmar.
ETYMOLOGY. From the Greek *eu-* (beautiful) and *blepharos* (eyelids) in reference to the serrate-fimbriate petals.

21. **B. parviflorum** Parish & Rchb. f. in Trans. Linn. Soc. London 30: 152 (1874). Type: Myanmar (Burma), Tenasserim, *Parish* 305 (holo. W! Herb. no. 2273, iso. K!).
Phyllorchis parviflora (Parish & Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic, 13–19cm tall; *rhizome* woody, sheathless, annulate, 2–3mm thick; *roots* densely caespitose from pseudobulb base, filiform. *Pseudobulbs* ovoid-discoid, 0.8–1.1 × 0.4–0.6cm, inserted at intervals of 2–5cm along rhizome. *Leaf* oblong to narrowly oblong-elliptic, obliquely emarginate at apex, 8–13 × 0.8–2cm; petiole channelled, 1–3cm long. *Inflorescence* lateral from pseudobulb, slender, racemose, laxly to subdensely many-flowered; peduncle slender, sheathed, glabrous, 0.5–0.8mm; sheaths overlapping at base and distant above, lanceolate, acute, 2.5–4mm long; rachis slender, glabrous, 8–12cm long; floral bracts lanceolate, acute, 1–1.2 × 0.5–0.6mm. *Flowers* c.3mm across; sepals and petals white, lip green; pedicel and ovary slender, glabrous, 1.8–2mm long. *Dorsal sepal* broadly lanceolate, obtuse, margins ciliate, 1-veined, 2.4–2.5 × 0.9–1mm; *lateral sepals* broadly lanceolate, obtuse, margins ciliate, 1-veined, 2.7–2.8 × 0.9–1mm. *Petals* oblong, subacute, 1-veined, margins ciliate, 1.8–2 × 0.5–0.6mm. *Lip* simple, oblong-spathulate, margins ciliate, base grooved, 2.5–3.2mm long. *Column* c.0.8mm long; stelidia 2, triangular; foot 1.5mm long.

Bhutan: S – Chukka district (Marichong). 1160m. Fl. November.

GENERAL DISTRIBUTION. NE India and Myanmar.
ETYMOLOGY. From the Latin *parvus* (small) and *-florus* (flowered).
NOTES. *B. parviflorum* is very closely related to *B. thomsonii*, differing only in its colour and some minor floral details. The only material of *B. parviflorum* we have seen flowers in November and further collections are needed to confirm whether or not it should be retained as distinct. This is the first report of the species from Bhutan.

22. **B. penicillium** Parish & Rchb. f. in Trans. Linn. Soc. London 30: 151 (1874). Type: Myanmar (Burma), Moulmein, *Parish* 303 (holo. K!).
Phyllorchis penicillium (Parish & Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).
Bulbophyllum inopinatum W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 8: 346 (1915). Type without provenance, cult. Edinburgh B.G. (holo. E).

Plant epiphytic: *rhizome* woody, terete, 3–4mm wide; *roots* arising from nodes, slender, clustered. *Pseudobulbs* broadly ovoid to subcylindric, 3 × 0.8–1.6cm (towards base), inserted at intervals of 2–3cm along rhizome. *Leaf* 1, oblong-lanceolate, acute, 14–15 × 2.7–2.9cm; petiole channelled, 4–7.5cm long. *Inflorescence* lateral from base of pseudobulb, racemose, laxly many-flowered; peduncle glabrous, sheathed basally and at intervals above, 15–21cm long; sheaths overlapping at base, lanceolate, acute, adherent, 0.7–1.3cm long; rachis decurved, 10–18cm long; floral bracts large, lanceolate-ovate, acuminate, 5–8 × 1–2mm. *Flowers* 0.6–1.1cm long; sepals and petals uniformly brown to yellow-brown with purple veins, lip pale brown, column yellowish; pedicel and ovary 5–6mm long. *Dorsal sepal* narrowly lanceolate, caudate-acuminate, base strongly 5-veined, 0.8–1 × 0.2cm; *lateral sepals* similar, base broader and adnate to column foot, 0.8–1 × 0.25–0.3cm. *Petals* orbicular, fleshy, apical margins softly fimbriate-bearded, 1 × 0.7mm. *Lip* simple, highly mobile, lanceolate, base truncate, auriculate, margins long fimbriate-echinate, 3 × 1mm. *Column* stout, 0.7–1mm long; foot curved, 1–1.2mm long; stelidia 2, long-acuminate, 1.5mm long; anther cap fimbriate.

Sikkim (Song-chong-loo?). 2000m. Fl. August–September(–January).

GENERAL DISTRIBUTION. NE India, Myanmar and Thailand.
ETYMOLOGY. From the Latin *penicillus* (covered with tufts of hair, brush-like) in reference to the lip and petals.
NOTES. There is an unpublished drawing of this species by Parish in his drawings of Orchideae (t.12) at Kew. King & Pantling (1898) described the movement of the lip as spasmodic and jerky rather than oscillatory. King & Pantling (1898) reported the flowering time of this species as August and September

but their flowering specimen (no. 251) is dated January. Vermeulen (1987) treated B inopinatum as conspecific with this species.

23. **B. secundum** Hook. f., Fl. Brit. India 5(2): 764 (1890); Icon. Pl. 21: t.2042 (1892). Type: India, Upper Assam, Naga Hills, Kohima, *Prain* 41 (holo. K!).
Phyllorchis secunda (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 678 (1891).

Plant epiphytic, 7–17cm tall; *rhizome* slender, 1–1.5mm thick; *roots* filiform, arising from nodes. *Pseudobulbs* crowded, discoid-turbinate, flat, 5–7mm across, inserted at intervals of 0.5–3.5cm along rhizome. *Leaf* 1, linear-oblong, subacute, narrowed at base, 3.5–6 × 0.4–0.6cm; petiole channelled, 0.5–1cm long. *Inflorescence* basal from pseudobulb, filiform, erect, racemose, secund, laxly 12- to 20-flowered; peduncle glabrous, sheathed at base and at intervals above, 7–10cm; sheaths overlapping at base, appressed-tubular, 3–4mm long; rachis filiform, glabrous, 6–8cm long; floral bracts ovate-lanceolate, acute, 0.8–1.2 × 0.3–0.5mm. *Flowers* 2–3mm long; sepals pale purple with darker veins, petals pale purple with a purple blotch near the tip, lip deep purple with 4 pale lines, column green, column foot purple; pedicel and ovary glabrous, 1.5–2.5mm long. *Dorsal sepal* lanceolate, subacute, 1-veined, margins ciliate, 2.8–3 × 1–1.2mm; *lateral sepals* ovate, subacute, 3-veined, adnate at base to column foot, 2.5–3 × 1.8–2mm. *Petals* oblong-spathulate, obtuse, 1-veined, apical margin long-ciliate, 1.4–1.6 × 0.6–0.8mm. Lip simple, oblong, base truncate to weakly cordate, dilated centrally, obtuse, margins ciliate, 1.8–2.1mm long. *Column* straight, c.1mm long; stelidia 2, anterior, shortly triangular; foot short, curved; anther cap margins erose. *Fruit* cylindric, truncate, stalked, 3–3.5 × 1.8–2mm.

Bhutan: C – Punakha district (Jala, Ngawang); **Sikkim** (Chunthang, Lachen Valley). In temperate forests, on *Lyonia ovalifolia*; 1500–2100m. Fl. May–July; Fr. June.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China (Yunnan), Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *secundus* (on one side only) in reference to the inflorescence.

24. **B. thomsonii** Hook. f., Fl. Brit. India 5(2): 764 (1890); Icon. Pl. ser.4(2), 21: t.2041 (1892), non *B. thompsonii* Ridley (1885). Type: India, Sikkim, *Thomson* s.n. (holo. K!).
Phyllorchis thomsonii (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 678 (1892).

Plant epiphytic or lithophytic, 16–18cm tall; *rhizome* sheathless, 3–4mm thick; *roots* filiform, clustered, arising from nodes of rhizome. *Pseudobulbs* depressed-obturbinate to subconical, oblique, 1.2–1.8 × 1–1.2cm (at base), inserted at intervals of 5–10cm along rhizome. *Leaf* 1, linear-oblong, acute, narrowed at base, 12–17 × 1.4–2.1cm; petiole channelled, 2.4–2.9cm long. *Inflorescence* basal from pseudobulb, racemose, erect, subdensely many-flowered; peduncle slender, glabrous, sheathed at base, 7.5–10.5cm long; sheaths 4, overlapping, tubular-appressed, 0.5–1.4cm long; rachis glabrous, 6–13cm long; floral bracts lanceolate-ovate, acute, 1.5–2 × 0.4–0.6mm. *Flowers* 5–8mm across, uniformly yellowish-white; pedicel and ovary glabrous, 2.5–3mm long. *Dorsal sepal* ovate-lanceolate, acute to acuminate, 3.5–4.5 × 0.5–1.2mm; *lateral sepals* ovate-lanceolate, acute to acuminate, weakly falcate, margins ciliate, 1-veined, adnate to column foot at base, 3.5–5 × 1.4–1.6mm. *Petals* lanceolate, acute, 1-veined, margins ciliate, 1.4–1.5 × 0.5–0.6mm. *Lip* simple, thick, shortly clawed at base, oblong-spathulate, apex obtuse, upper surface with an elongate depression near base, margins ciliate-villose, 2–2.2 × 0.3–0.5mm. *Column* c.1mm tall; foot straight to curved, 1.4–1.6cm long; stelidia minute; anther cap papillose.

Bhutan: S – Chukka (Raidak Valley) and Sarbhang (Kami Khola) districts; C – Mongar district (E of Lhuntse (M.F.B.)); **Darjeeling** (Ghoom to Kurseong); **Sikkim** (between Damthang and Gangtok). 800–2200m. Fl. June–July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after Thomas Thomson (1817–1878) who collected plants with Hooker in the Himalayas in 1849.

NOTE. This is not to be confused with *Cirrhopetalum thomsonii* Hook. f., a S Indian species which Kuntze renamed *Phyllorchis hookeri* Kuntze and Seidenfaden (1973b) as *Bulbophyllum fischeri* Seidenfaden.

Section **Globiceps** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 704 (1912).

25. **B. cornu-cervi** King & Pantling in J. Asiat. Soc. Bengal 64(3): 332 (1896). Type: India, Sikkim, base of Engo Ridge. *Pantling* 264 (holo. CAL, iso. BM! K!).

Plant epiphytic, 5–6.5cm tall; *rhizome* attenuate; *roots* clustered, worm-like. *Pseudobulbs* crowded, globose, 1.5–2mm across. *Leaf* 1, coriaceous, obovate-elliptic to elliptic, obtuse, entire, tapered at base, 2–3 × 1.1–1.8cm; petiole channelled, 0.8–1.2cm long. *Inflorescence* basal, erect, racemose, laxly 6- to 15-flowered; peduncle slender, sheathed, glabrous, 2.6–4cm long; sheaths distant, broadly lanceolate, acute, 4–5mm long; rachis glabrous, 1.5–3cm long; floral bracts ovate, acute, 1–1.5 × 0.2–0.3mm. *Flowers* 2–4mm across; sepals green with reddish-brown margins, petals green, lip yellow with a reddish-brown base, column white, column foot reddish-brown; pedicel and ovary glabrous, 1–1.5mm long. *Dorsal sepal* oblong, obtuse, hooded, 2.5 × 1mm; *lateral sepals* broadly oblong, acute, subspreading, margins incurved, 2.5 × 1.2mm. *Petals* lanceolate, weakly falcate, acute, 1-veined, c.1 × 0.5mm. *Lip* simple, fleshy, obovate-oblong, deflexed centrally, stipitate, c.1mm long; base grooved; apex convex, entire, obtuse. *Column* 0.3–0.4mm long; stelidia 2- or 3-toothed; foot flat, weakly curved, with a raised median ridge; anther cap compressed.

Sikkim (Engo Plateau). 800m. Fl. April(–July).

GENERAL DISTRIBUTION. Probably endemic (Jain & Mehrotra, 1984).
ETYMOLOGY. From the Latin *cornu* (an animal's horn) and *cervus* (a stag) in reference to the resemblance of the stelidia to the antlers of a deer.
NOTES. *B. cornu-cervi* is related to *B. alcicorne* Parish & Rchb. f. but the latter species has a distinct rhizome, oblong leaves and a deflexed inflorescence. The type material is poor and further collections of living material are needed before their relationship can be resolved.

26. **B. cylindraceum** Wall. ex. Lindl., Gen. Sp. Orchid. Pl.: 53 (1830). Type: India, without precise locality, icon. Wallich 1117 (holo. K!).
Bulbophyllum imbricatum Griff., Not. Pl. Asiat. 3: 289 (1851). Type: India, Khasia Hills, Myrung, Griffith 151 (holo. K!).
Phyllorchis cylindraceum (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic, 14–25cm tall; *rhizome* creeping; *roots* slender, clustered, basal, 0.5–1mm across. *Pseudobulbs* attenuate, sheathed, 6–8mm long; sheaths lanceolate, acute, brown, 1.5–4cm long. *Leaf* 1, oblong-lanceolate, acute, 11.5–14 × 2.4–2.9cm; petiole folded, 3.5–9cm long. *Inflorescence* erect, cylindric, racemose, with a large bract at base, densely many-flowered; inflorescence bract lanceolate, acute, involute, brown, 1.7–2 × 0.7–0.9cm; peduncle erect, sheathed, 13–24cm long; sheaths distant, lanceolate, acute to acuminate, brown, 1.7cm long; rachis 2.5–7cm long; floral bracts ovate-lanceolate, acuminate, 3–4 × 1.5–2mm. *Flowers* overlapping, 3–4mm across, colour variable, sepals and petals white to lilac-purple or brown, lip white or yellowish to lilac purple, column white; pedicel and ovary 2–2.5mm long. *Dorsal sepal* ovate, acuminate, apex recurved, 3 × 2mm; *lateral sepals* ovate, obtuse, unequal, inner edges straight, parallel, connivent at base, glandular-pubescent, 3.5–6 × 3.2–4mm (across the pair). *Petals* ovate, obtuse to truncate, 2 × 1mm. *Lip* simple, fleshy, ovate, obtuse, sigmoidally deflexed, papillose, 2 × 1.2mm. *Column* erect, apex 3-lobed, toothed, 1mm tall.

Darjeeling (Kurseong); **Sikkim** (unlocalised *Clarke* specimen). Fl. October.

GENERAL DISTRIBUTION. ?Nepal and NE India.
ETYMOLOGY. From the Latin *cylindraceus* (cylindric) in reference to the inflorescence.

NOTES. The type illustration shows a plant with white flowers and a yellow lip. The relationship between this species and B. *khasyanum* has caused confusion over the years. Joseph Hooker (1890) thought that the type illustration was 'grossly exaggerated' and questioned the flower colour. Finet (1909) and Seidenfaden (1973a, 1979) discussed the difference between them and concluded that the species were distinct, with which we agree. B. *cylindraceum* has a long, cylindric inflorescence subtended by a distinctive large bract which is not found in B. *khasyanum*.

27. B. gracilipes King & Pantling in J. Asiat. Soc. Bengal 65(2): 119 (1896). Types: India, Sikkim, Tista, *Pantling* 242 A (syn. CAL, isosyn. BM! K! W!); Sikkim, 242B (syn. CAL, isosyn. AMES!).

Plant epiphytic, lacking pseudobulbs; *rhizome* thick, bearing remains of sheaths and leaves inserted at intervals of 1.5–2.5cm; sheaths filiform (appearing as dense woolly-pubescence), widened at base, 5–9mm long. *Leaf* 1, coriaceous, oblanceolate to elliptic-oblanceolate, obtuse, apex minutely bifid, narrowed to subsessile to shortly petiolate base, 2.5–5.5 × 1–1.8cm; petiole channelled, 3–9mm long. *Inflorescence* erect, capitate-globose, 6–8mm across, densely 8- to 12-flowered; peduncle filiform, sheathed; sheaths distant, lanceolate, acute, 2–6mm long; floral bracts ovate, acute, 1–1.2 × 0.3–0.8mm. *Flowers* fleshy, 3–3.5mm across, uniformly dull purple; pedicel and ovary 1–1.5mm long. *Dorsal sepal* triangular, narrowed to subacute apex, 3-veined, close to column, 2.2–2.5 × 1.4–1.5mm; *lateral sepals* ovate, acute, subspreading, 3-veined, 1.6–2 × 1.2–1.4mm. *Petals* oblong, falcate, acute, 1-veined, 1.4–1.6 × 1–1.2mm. *Lip* obovate, swollen, decurved from the middle, surface papillose, 1.5 × 1mm; apex convex, dilated, margins entire, broad, base deeply grooved. *Column* erect, apices pointed, with a short foot, c.1mm long.

Sikkim (Engo?, Tista River Valley). 500–660m. Fl. September–October(–November).

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Latin *gracilis* (slender) and *pes* (foot) probably a reference to the peduncle.
NOTES. B. *gracilipes* is closely related to B. *xylophyllum* Parish & Rchb. f. from Myanmar; Seidenfaden (1979) considered them to be conspecific, while King & Pantling (1898) had considered them to be distinct. Seidenfaden noted that the flowers of B. *xylophyllum* were yellowish-green rather than dull purple and that the lateral sepals were rounded rather than acute. These features are confirmed by the Parish plate no.82B (in Parish, Drawings of Orchideae, p.14 at K). This plate also shows the floral bracts as narrowly lanceolate amd acuminate, whereas they are ovate and acute in B. *gracilipes*. Seidenfaden correctly observed that in B. *gracilipes* the dorsal sepal does not have a minute spur at its base. The type material is in a poor state and the flowers are fragmented but the leaves are broadly ovate, emarginate and petiolate. Clearly these two species are closely allied but Garay, Hamer & Siegerist (1994) kept them distinct, and we follow this until further collections are available.

28. B. khasyanum Griff., Not. Pl. Asiat. 3: 284 (1851). Type: India, Khasia Hills, Surureem, *Griffith* s.n. (holo. K-LINDL!).
Bulbophyllum conchiferum Rchb. f. in Walpers, Ann. Bot. Syst. 6: 253 (1861). Type: India, Khasia Hills, *Lobb* s.n. (holo. K-LINDL!).
B. *gibsonii* Lindl. ex Rchb. f. in Gard. Chron. n.s. 10: 716 (1878), nom. nud.
B. *bowringianum* Rchb. f. in Gard. Chron. n.s. 15: 814 (1881). Type: India, Assam, cult. *Bowring* s.n. (holo. W! Herb. no. 28496).
B. *cylindraceum* var. *khasyanum* (Griff.) Hook. f., Fl. Brit. India 5(2): 765 (1890).
Phyllorchis conchifera (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic, 23–35cm tall; *rhizome* creeping, thick; *roots* slender. *Pseudobulbs* attenuate. *Leaf* 1, oblong-lanceolate, obtuse, 1-veined, coriaceous, 10–18 × 2.3–4.4cm; petiole channelled above, terete below, glabrous, 4–10cm long. *Inflorescence* racemose, erect, subcylindric, densely many-flowered; peduncle slender, sheathed, 15–31cm tall; sheaths distant, lanceolate, appressed, 0.6–2cm long; rachis deflexed, 2.2–3.5cm long; floral bracts variable, ovate-lanceolate, acute to acuminate, concave, 2–5 × 0.8–2mm. *Flowers* overlapping, 3–4mm across; sepals and petals dark red-purple, lip brown-purple, column yellow-white, pink inside; pedicel and ovary glabrous, 3–4mm long. *Dorsal sepal* triangular to weakly cordate-lanceolate, acute to acuminate, recurved at apex, 2.5–3 × 1–2mm; *lateral sepals* ovate, acute, unequal, inner edges straight, parallel, connivent at base, pubescent, thick, 3-veined, 3 × 3mm (across the pair). *Petals* oblong, denticulate, 1-veined, 2.5 × 1.5mm. *Lip* jointed with the column base, simple, oblong, decurved towards base, 2.5–3mm long. *Column* erect with a short foot, slipper-shaped, 3-toothed at apex, teeth linear, 1–1.5mm long.

Darjeeling (Labha); **Sikkim** (Lachen, Neebay?, Yoksam). 1660–2330m. Fl. October–January.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Khasia Hills of Meghalaya, where the type specimen was collected.

29. B. piluliferum King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 76, t.104 (1898). Type: India, Sikkim, *Pantling* 141 (holo. CAL).

Plant epiphytic. *Pseudobulbs* caespitose, globose or depressed-globose, 5–7mm across. *Leaf* 1, fleshy, linear-oblong, obtuse, entire, narrowed towards base, 10.2 × 1.3cm; petiole 3–4mm long. *Inflorescence* racemose, semi-globose, dense; peduncle slender, erect, sheathed, c.6.6cm long; sheaths 1 or 2 at base, and 1 or 2 along peduncle; rachis 1 3cm long; floral bracts lanceolate, acute. *Flowers* 2mm across; sepals and petals pale reddish-brown with darker streaks, lip dark reddish-brown; pedicel and ovary subsessile. *Dorsal sepal* lanceolate, acute, tips spreading; *lateral sepals* ovate, acute, parallel, tips spreading. *Petals* narrowly lanceolate, acute, shorter than the sepals. Lip deflexed at base, simple, elliptic, swollen, papillose; apex convex with entire edges, rounded; base deeply grooved. Column very short, apical process triangular, erose; foot long; anther cap truncate, margins erose; pollinia pyriform.

Sikkim (Tista River Valley). 330m. Fl. May.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Latin *pilula* (a little ball) and *-fer* (to bear or carry) in reference to the small globose pseudobulbs.

NOTES. This species was originally collected by R. Pantling from Sikkim and was not reported again until Hegde & Rao (1983b) found it in Arunachal Pradesh. Jain & Mehrotra (1984) considered it to be extinct in Sikkim. We have seen no material and the description has been taken from King & Pantling (1898). Garay, Hamer & Siegerist (1994) divided the section *Globiceps* into three groups and treated this species in the '*Piluliferum* group'.

30. B. rigidum King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 69, t.94 (1898). Types: India, Darjeeling, *Griffith* 5291 (syn. K!); India, Sikkim, *Pantling* 42A (syn. CAL, isosyn. BM! K! W!).

Plant epiphytic, erect, 18–30cm tall; *rhizome* thick, covered with fibrous sheaths, 3–5mm wide; *roots* worm-like, inserted along rhizome. *Pseudobulbs* attenuate, conical, sheathed, 2–6 × 1.5–4mm, sometimes absent. *Leaf* 1, ovate-elliptic, subacute to obtuse, narrowed at base, base sheathed, inserted at intervals of 1.5–3cm along rhizome, 8.5–22 × 2.2–3.4cm; petiole 2.5–8cm long; sheath lanceolate, acute, 3.5–4cm long. *Inflorescence* basal from rhizome, racemose, erect, laxly 7- to 20-flowered; peduncle slender, sheathed, glabrous, 9–19cm long; sheaths distant, lanceolate, appressed, 1.1–1.7cm long; rachis glabrous, decurved, 3–10cm long; floral bracts ovate-lanceolate, acute, 1-veined, 5–6 × 1.5–2mm. *Flowers* opening from apex to base, non-resupinate, 4–6mm long; sepals and petals brownish-yellow flushed green with purple veins, lip brownish-yellow, red-spotted at base, column greenish, spotted with purple; pedicel and ovary broad, c.2mm long. *Dorsal sepal* ovate-lanceolate, acute, 3-veined, spreading, 4–4.5 × 1.8–2mm; *lateral sepals* oblong, obtuse, connate below (for 3–3.5mm), 3-veined, 5–6.5 × 1.8–2mm (3.5–4mm across conjoined base). *Petals* oblong, subacute, apex erose, 1-veined, 2.5–3.5 × 0.7–0.9mm. *Lip* simple, elliptic-oblong, obtuse, margins deflexed, glabrous, base grooved, 3.5 × 1mm. *Column* broad, 1.2–1.9mm long; stelidia 3-toothed; anther cap depressed.

Darjeeling (Rishep?); **Darjeeling/Sikkim** (Great Rangit River); **Sikkim** (unlocalised *Pantling* specimens). In S-facing mixed, wet, evergreen, temperate forests; 1000–2000m. Fl. (May–June (King & Pantling, 1898)) July–August.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Latin *rigidus* (rigid) but to which part this refers is unclear.
NOTES. Seidenfaden (1979) suggested that this species should be treated within section *Aphanobulbon* but that he was doubtful whether or not to split *Aphanobulbon* from *Globiceps*. Vermeulen (pers. comm.) believes, because of its outward-folded lateral sepals, flower colour and stelidia, that it belongs within section *Globiceps* and we follow this treatment here.

Section **Aphanobulbon** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 10: 181 (1911); Feddes Repert. Spec. Nov. Regni Veg. Beih. 1(9): 704 (1912) & 1(11): 874 (1913).

31. **B. apodum** Hook. f., Fl. Brit. India 5(2): 766 (1890); Icon. Pl. ser.4, 21: t.2043 (1892). Types: Malay Peninsula, Malacca, *Maingay* 3244 (syn. K!); Perak, top of Batu Kurau, *Scortechini* s.n. (syn. K!).
Phyllorchis apoda (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).
Bulbophyllum ebulbum King & Pantling in J. Asiat. Soc. Bengal 64(3): 334 (1896), **syn. nov.** Type: India, Darjeeling, Sivoke (Sivok), *Pantling* 323 (holo. K!).

Plant epiphytic, 22–24cm tall; pseudobulbs absent; *rhizome* slender to stout, 3–5mm thick; *roots* arising from nodes, clustered. *Leaf* 1, oblong-lanceolate, obtuse to subacute, inserted at intervals of 4–7cm along rhizome, 13.5–19 × 2.4–2.8cm; petiole channelled, 5.5–6.5cm long. *Inflorescence* basal, close to leaf, racemose, arcuate, laxly many-flowered; peduncle short, sheathed at base, 3–4cm long; sheaths basal, overlapping, tubular, 0.6–1.4cm long; rachis slender, glabrous, 7–10.5cm long; floral bracts lanceolate-triangular, acuminate, 2–2.5 × 0.5–0.7mm. *Flowers* 3–4mm long, uniformly pale green to greenish-yellow; pedicel and ovary slender, 2–2.5mm long. *Dorsal sepal* oblong-lanceolate, acute, 1-veined, hooded, 4–4.3 × 1–1.2mm; *lateral sepals* lanceolate, falcate, acute to acuminate, base broad, adnate with column foot, 1- to 3-veined, 4–4.3 × 1.2–1.4mm; *mentum* short, rounded, c.1mm long. *Petals* linear-oblong, obtuse, 1-veined, 2.1–2.3 × 0.3–0.8mm. *Lip* abruptly decurved, simple, obscurely 3-lobed, 3-veined, subacute, margins entire, base subauriculate to pyriform (when spread), folded upwards to form a central groove, 2.8–3.1 × 1.2–1.4mm (at base when spread). *Column* 0.7–0.9mm; foot curved, c.1.3mm long; stelidia 2, triangular.

Darjeeling (Sivok). 330–500m. Fl. May.

GENERAL DISTRIBUTION. NE India, Thailand, Vietnam, Malaysia, Sumatra, Java and Borneo.
ETYMOLOGY. From the Greek *a-* (without) and *podion* (foot) in reference to the lack of pseudobulbs.
NOTES. Seidenfaden (1992) considered that *B. ebulbum* might be conspecific with *B. apodum* Hook. f. and having carefully examined the type material of both species we agree with him. When describing *B. ebulbum*, King & Pantling considered that the lack of basal auricles on the lip was its main distinguishing feature, but when the Sikkim material was examined and the lip spread, it was found to have a pyriform or subauriculate base.

32. **B. hymenanthum** Hook. f., Fl. Brit. India 5(2): 767 (1890); Icon. Pl. 21: t.2046 (1890). Type: India, Khasia Hills, Myrtung, *Hooker & Thomson* 1525 (holo. K!).
Phyllorchis hymenantha (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic, 1.5–2cm tall, lacking pseudobulbs; *rhizome* filiform, sheathless, 0.5–1mm wide; *roots* arising from nodes, short. *Leaf* 1, borne directly on rhizome, ovate-elliptic to suborbicular, obtuse, sessile to shortly petiolate, fleshy, 0.8–1.4 × 0.4–0.9cm; petiole 1–2mm long. *Inflorescence* erect, basal from rhizome, 2-flowered; peduncle filiform, sheathed, 2.4–3cm long; sheaths distant, lanceolate, acute, membranous, 2–2.5mm long; floral bracts ovate-lanceolate, acute, 2 × 0.5mm. *Flowers* 6–7mm across; sepals and petals yellowish, streaked with purple, lip purple; pedicel and ovary glabrous, slender, c.3mm long. *Dorsal sepal* spreading, lanceolate-ovate, acute, 3-veined, membranous, 6–8 × 2–2.5mm; *lateral sepals* spreading, ovate, 3-veined, acute, base broad, 6–6.5 × 3–3.5mm. *Petals* elliptic-lanceolate, subacute to obtuse, 1-veined, membranous, 3–4 × 0.8–1.1mm. Lip abruptly deflexed near base, simple, ovate-lanceolate, upper surface grooved, apex narrowed, base weakly cordate, stipitate, 4–5mm long. *Column* 0.8–1mm long; lacking stelidia; foot curved, c.2.5–3mm long.

Bhutan: C – Punakha district (Neptengka, Rimchu (field record)); **Sikkim** (Lachen, Lachung, Rhenok, Yoksam). On branches of pine trees; (1000–)1600–2330m. Fl. May–July.

GENERAL DISTRIBUTION. NE India and Thailand.
ETYMOLOGY. From the Greek *hymen-* (thin-textured) and *anthos* (flower).

Section **Tripudianthes** Seidenfaden in Dansk. Bot. Ark. 33(3): 188 (1979).

33. **B. wallichii** (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 259 (1861). Type: Nepal, Sheopore, coll. *Wallich* Wall. Cat. 1980 (holo. K-LINDL!, iso. K-W! K!).

Cirrhopetalum wallichii sensu Lindl. in Bot. Reg. 25: misc.72, no.119 (1839); Bot. Reg. 29: sub t.49, no.8 (1843), *non* Lindl. (1830).
C. refractum sensu Hook. f., Fl. Brit. India 5(2): 779 (1890), *non* Zollinger (1847).
Bulbophyllum refractoides Seidenfaden in Bot. Tidsskr. 65: 342 (1970).

Plant epiphytic, caespitose; *rhizome* attenuate, narrow; *roots* filiform. *Pseudobulbs* shortly conical, broad-based, rugose at flowering, 1–2.5 × 0.6–1.9cm. *Leaves* 2 (absent at flowering), from pseudobulb apex, oblong to oblong-elliptic, acute to subacute, sessile to shortly petiolate, 10–13 × 1.2–2.9cm; petiole channelled, 5–6mm long. *Inflorescence* lateral from pseudobulb, erect, racemose, laxly 4- to 12-flowered; peduncle slender, decurved, sheathed, 8–13cm long; basal sheaths 2, tubular, 4–5mm long, upper ones 2, lanceolate, acute, 0.5–1.6cm long; rachis pendent, glabrous, 4–10cm long; floral bracts narrowly lanceolate to ovate, acute to acuminate, 3–9 × 1–4mm. *Flowers* 2–7cm long; lateral sepals pale green to brown, dorsal sepal, petals and lip pale yellow, with purple spots and hairs; pedicel and ovary 2.5–3mm long. *Dorsal sepal* free, narrowly lanceolate, aristate, margins ciliate, 3-veined, 6–9 × 0.8–1.2mm; *lateral sepals* connivent along centre but separate at base, linear-oblong, subacute, very sparsely ciliate, 2–6 × 0.4–0.7cm (across the conjoined pair); unjoined basal section 5–7mm long. *Petals* fleshy, lanceolate-triangular, aristate, margins ciliate, 2.5–3.5 × 0.8–1mm. Lip simple to obscurely 3-lobed (when spread), oblong, obtuse, basal edges recurved, deflexed centrally, apex glandular pubescent, 1.8–2.2mm long. *Column* c.1mm tall; stelidia aristate, slender, decurved; foot short, curved; anther cap papillose.

Bhutan: S – Phuntsholing (Kamji (M.F.B.)) and Gaylegphug (Surelakha (M.F.B.)) districts; **Darjeeling** (Dumsong); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). 1000–2500m. Fl. November–December.

GENERAL DISTRIBUTION. NW India, Nepal, NE India, Myanmar and Thailand.
ETYMOLOGY. Named after Nathaniel Wallich (1786–1854), Superintendent of the Calcutta Botanic Garden from 1815 to 1841, who collected the type material.
NOTES. Seidenfaden (1979) reviewed the complex and confused taxonomic history of *Cirrhopetalum wallichii* Lindl. 1830 and *C. wallichii* Lindl. 1839. This latter species is closely related to *B. refractum* (Zollinger) Rchb. f., from Vietnam, Java and Sumatra which has a larger, broadly elliptic to ovate dorsal

sepal than *B. wallichii*. King & Pantling (1898) reported *Cirrhopetalum refractum* Zollinger from Sikkim and Rao & Balakrishnan (1973) from Bhutan, but both these records refer to *B. wallichii* and we do not believe that *B. refractum* occurs in our area.

Section **Pleiophyllum** J.J. Smith in Bull. Jard. Bot. Buitenzorg 2(13): 34 (1914).

34. **B. cariniflorum** Rchb. f. in Walpers, Ann. Bot. Syst. 6: 253 (1861). Type: India, Khasia Hills, *Lobb* s.n. (holo. K-LINDL!).

Bulbophyllum densiflorum Rolfe in Bull. Misc. Inform. Kew 1892: 139 (1892). Type: E Himalaya, cult. N. Campany s.n. (holo. K!).

Plant epiphytic; *rhizome* creeping; *roots* clustered from pseudobulb base, filiform. *Pseudobulbs* obturbinate or ovoid to cylindric, ridged, flattened, 1.7–3 × 1.7–2.5cm. *Leaves* 2, present at flowering, fleshy, elliptic to broadly elliptic, acute, 8–20 × 2.7–3.5cm; petiole channelled, 0.8–1.2cm long. *Inflorescence* basal from pseudobulb, racemose, subdensely 10- to 20-flowered; peduncle erect, sheathed, glabrous, 7.5–10.5cm long; sheaths distant, lanceolate, acute, 0.9–1.2cm long; rachis abruptly decurved, glabrous, 3–4cm long; floral bracts lanceolate, acute, 2–3 × 0.5–1mm. *Flowers* foetid, 5–8mm across; sepals and petals light greenish-yellow, lip bright yellow; pedicel and ovary glabrous, 3–4mm long. *Dorsal sepal* ovate, concave, 3-veined, 4.5–5 × 2–3mm; *lateral sepals* connate from base to near apex, broadly ovate, apex acute, keeled, adnate to the column foot, 6–7 × 3.5–4mm. *Petals* linear-oblong, acute, 1-veined, 2.8–3.2 × 0.75–1mm. *Lip* simple, oblong, margins entire, base orbicular to wedge-shaped, fleshy, 3–3.5 × 1.5–2mm. *Column* c.1mm long; stelidia 2, narrowly triangular; foot curved, 2–2.3mm long. *Fruit* ovoid, shortly stalked, 6–9 × 3–6mm.

Bhutan: C – Tashigang district (near Tashi Yangtsi (M.F.B.)); **Darjeeling** (unlocalised *Gamble* specimen). 1330–1800m. Fl. July–August; Fr. September.

GENERAL DISTRIBUTION. S and NW India, Nepal, NE India (Arunachal Pradesh, Assam).
ETYMOLOGY. From the Latin *carina* (keel) and *-florus* (flower) referring to the lateral sepals.
NOTES. *B. cariniflorum* is closely related to *B. pantlingii*, another yellow-flowered species which flowers in July and August, but the lateral sepals of that species are connate only at the base. Rao & Balakrishnan (1973) listed this species (as *B. densiflorum* Rolfe) as occurring in Bhutan, but the flowering date of March casts some doubt as to its identity.

35. **B. hirtum** (J.E. Smith) Lindl., Gen. Sp. Orchid. Pl.: 51 (1830). Type: Upper Nepal, *Buchanan-Hamilton* s.n. (holo. LINN! Herb. no. 1405.4, iso. BM!).

Stelis hirta J.E. Smith in Rees, Cycl. 34: Stelis, no.11 (1819).

Tribrachia hirta (J.E. Smith) Lindl., Coll. Bot.: 41 (1826).

Bulbophyllum suave Griff., Not. Pl. Asiat. 3: 292 (1851). Type: India, Darjeeling, *Campbell* s.n. (holo. K, not found).

Phyllorchis hirta (J.E. Smith) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic; *rhizome* 3mm thick; *roots* filiform, densely clustered, arising from nodes. *Pseudobulbs* crowded, ovoid-cylindric to globose, terete, apex with a scarious collar, 0.9–1.4 × 1–3cm, inserted at intervals of 2–6mm along rhizome. *Leaves* 2, absent at flowering, oblong-lanceolate to oblong-obanceolate, flaccid, subacute, base equitant, 11–16.5 × 1.6–3.1cm; petiole 5–9mm long. *Inflorescence* basal from pseudobulb, erect, racemose, densely many-flowered; peduncle sheathed, glabrous, 16–20cm tall; sheaths distant, lanceolate, acute, veined, 7–9mm long; rachis pendent, glandular-pubescent, 8–22cm long; floral bracts broadly ovate, acute, entire, 2–3 × 1–1.8mm. *Flowers* strongly fragrant, 4–7mm long; sepals pale yellow-green externally, white within, lip yellow, column white, pollinia yellow; pedicel and ovary densely glandular-pubescent, 3.5–4.5mm long. *Dorsal sepal* lanceolate, acute, densely glandular-pubescent externally, 1-veined, 5–7 × 1.5–2mm; *lateral sepals* lanceolate, caudate-acuminate, falcate, densely glandular-pubescent externally, 1-veined, converging, 5–7 × 1.5–2mm. *Petals* ovate, acute, margins ciliate, 1-veined, 1–1.5 × 0.4–0.7mm. *Lip* decurved, simple, oblong; epichile decurved, broad, emarginate, upper surface papillose at margins, grooved centrally, 2–3 × 0.5–0.8mm. *Column* 1–1.5mm tall; foot curved; stelidia minute.

Darjeeling (Pedong, ?Rishep); **Sikkim** (Kendong, Rimbi Chhu); **Chumbi** (unlocalised King specimen). In *Shorea robusta* forest; 1000–2660m. Fl. October–January.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China (Xizang), Thailand and Vietnam.

ETYMOLOGY. From the Latin *hirtus* (hairy) in reference to the flowers.

NOTES. The fragrance of this species has been described as resembling vanilla by Hooker (*in sched.*) and the grass *Anthoxanthum odoratum* L. by King & Pantling (1898). King & Pantling also noted that this species was prized by the Lepchas whose name for it was *sur-voo-reep* on account of its strong fragrance.

36. B. pantlingii S.Z. Lucksom in J. Bombay Nat. Hist. Soc. 90(3): 551 (1993). Type: India, Sikkim, Lachung Valley, *S.Z. Lucksom* 207 (holo. CAL!, iso. Gangtok Forest Dept. Herb.).

Bulbophyllum flavidum sensu S.Z. Lucksom in J. Bombay Nat. Hist. Soc. 90(1): 71 (1993), non (Bl.) Lindl. (1830).

Plant epiphytic or lithophytic, 14.5–21.5cm tall; *rhizome* stout, 3–4mm thick; *roots* pubescent. *Pseudobulbs* ovoid, broadly ridged, covered with fibrous sheaths when young, 2.5–3.5 × 1.6–2.7cm, inserted at intervals of 1.5–1cm along rhizome. *Leaves* 2, oblong-oblanceolate, acute, tapering at each end, sessile, flaccid, 15–21.6 × 4.8–5.5cm. *Inflorescence* lateral from pseudobulb base, erect; peduncle glabrous, terete, sheathed at base, 10.5–15cm long; sheaths overlapping, crowded; rachis slightly decurved, glabrous, 4–6.5cm long; floral bracts ovate, acute, margin wavy, c.2.5 × 1.5mm. *Flowers* 5.6–6mm long; sepals yellow, petals translucent white, lip orange-yellow; pedicel and ovary c.3mm long. *Dorsal sepal* oblong-ovate, obtuse, concave, 3-veined, 4.7–4.9 × 2.8–2.9mm; *lateral sepals* triangular, 3-veined, united ventrally at base, dorsally keeled, 5.6–5.7 × 3–3.2mm. *Petals* triangular, subacute, 1-veined, 3 × 1.2mm. *Lip* simple, oblong-ovate, obtuse, deflexed centrally, upper surface convex, grooved (2-ridged), 3 × 1.3mm. *Column* c.2.9 × 1.5mm; foot curved, c.1.5mm long; stelidia 2, triangular, acute; stigma orbicular; anther cap dome-shaped, papillose.

Sikkim (Lachung Valley, Phyang La (Lucksom, (1992)). On steep rocky crevices, on moss-covered rocks; 1000–2135m. Fl. July–August; Fr. November–December.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. Named after Robert Pantling in recognition of his work on the orchids of Sikkim.

NOTES. We have seen no material of this species and the description has been taken from the protologue. The original name for this species, *B. flavidum*, was a later homonym of *B. flavidum* (Bl.) Lindl. *B. pantlingii* is closely related to *B. triste* but differs in having yellow (rather than dull purple) flowers, lateral sepals adnate at the base only and a lip whose upper surface has 2 ridges on either side (rather than divided protruberances). It is also closely allied to *B. cariniflorum* which is also 2-leaved and has yellow flowers which appear between July and August but which has lateral sepals that are connate to the apex.

37. B. triste Rchb. f. in Walpers, Ann. Bot. Syst. 6: 253 (1861). Type: India, Khasia, *Lobb* s.n. (holo. W! Herb. no. 2255).

Bulbophyllum alopecurum Rchb. f. in Gard. Chron. n.s. 14: 70 (1880) Type without provenance (syn. W! Herb. no. 2253, 14822).

B. micranthum Hook. f., Fl. Brit. India 5(2): 768 (1890); Icon. Pl. 21: t.2048 (1892). Type: Myanmar, Toungoo, *Parish* 207 (holo. K!).
Phyllorchis alopecurus (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).
P. micrantha (Hook. f.) Kuntze, loc. cit. (1891).
P. tristis (Rchb. f.) Kuntze, loc. cit. (1891).

Plant epiphytic; *rhizome* branched, 1.5–2mm thick; *roots* filiform, from pseudobulb base. *Pseudobulbs* crowded, turbinate, umbonate, green-white, 0.6–1.8cm across, inserted at intervals of 0.4–1.5cm along rhizome. *Leaves* not seen [2, absent at flowering, oblong, weakly membranous, acute, narrowed to sheathing base, subsessile, 7–12 × 1.5–2cm]. *Inflorescence* basal from pseudobulb, racemose, subdensely many-flowered; peduncle erect, filiform, sheathed, 7–9cm long; sheaths distant, lanceolate, acute, 6–7 × 1–1.5mm; rachis pendent, glabrous, 1.5–2.8cm long; floral bracts linear-lanceolate, acute, 1.5–2 × 0.2–0.3mm. *Flowers* fragrant, 6–7mm across; dorsal sepal and petals purple, lateral sepals olive-brown, lip purple with yellow margins, column greenish-white to yellowish; pedicel and ovary obconical, 1.8–2.2mm long. *Dorsal sepal* oblong-ovate, acute, concave, 2.5–3 × 1–1.5mm; *lateral sepals* oblong, obtuse, concave, lateral margins incurved, free and weakly gibbous at base, cohering along median margin for three-quarters of length, 4–4.5 × 1.4–1.7mm. *Petals* ovate, acute, suboblique, 1-veined, 1.4–1.6 × 1.4–1.6mm (at base). *Lip* simple, adnate to column foot, broadly ovate to oblong-lanceolate, apex obtuse, base cordate, 1.5–2mm long. *Column* trigonous, 1.5mm long; stelidia linear; foot curved, 0.7–0.8mm; anther cap papillose. *Fruit* cylindric, shortly stalked, 1–1.4 × 0.25–0.35cm.

Darjeeling (unlocalised collection); **Sikkim** (Sembree?). On *Engelhardia spicata*; 1200m. Fl. March–June.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, NE India, Myanmar and Thailand.
ETYMOLOGY. From the Latin *tristis* (dark-coloured) in reference to the flower.
NOTES. The description of the leaves has been taken from the *Botanical Magazine* (Vol.148: t.8943 (1922)) and King & Pantling (1898).

38. **B. viridiflorum** (Hook. f.) Schltr. in Orchis 4: 108 (1910). Types: India, Sikkim, *Treutler* 947 (syn. K!); Khasia, Shillong, *Clarke* 5737 (syn. K!).
Cirrhopetalum viridiflorum Hook. f., Fl. Brit. India 5(2): 779 (1890); Icon. Pl. 21: t.2061 (1892).
Phyllorchis viridiflora (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 678 (1891).

Plant epiphytic; *rhizome* absent; *roots* filiform, clustered. *Pseudobulbs* caespitose, ovoid, 1.2–3 × 0.9–1.2cm (at base). *Leaves* 2, oblong-lanceolate, acute, thin, narrowed and subsessile at base, 6.5–11 × 1.5–2.5cm. *Inflorescence* basal from pseudobulb, racemose, densely many-flowered; peduncle erect, sheathed, 7.5–12cm long; sheaths 3, distant, lanceolate, acute, 1.2–1.4 × 0.25–0.35cm; rachis strongly decurved, 4.5–6cm long; floral bracts ovate-lanceolate, acute to acuminate, 3-veined, 5–6 × 1.5–2mm. *Flowers* 1–1.7cm long; sepals yellowish-green turning brown with age, petals yellow-green, gold or white edged with purple, lip purple, column pink-purple; pedicel and ovary slender, 4–5mm long. *Dorsal sepal* ovate-oblong, acute, concave, 5-veined, 0.5–1.2 × 0.3–0.4cm; *lateral sepals* ovate-lanceolate, connivent from base to apex, apex emarginate, lobules subacute, 1.4–1.8 × 0.5–0.7mm. *Petals* oblong-lanceolate, rounded, membranous, 1-veined, upper margins finely serrate, 2–3 × 0.8–1mm. *Lip* simple, fleshy, basal margins reflexed, deflexed centrally, margin finely crenulate, 1–1.6mm long. *Column* 1–2mm long; stelidia linear, falcate, hooked; foot curved, 2mm long; anther cap obovate, papillose.

Darjeeling (Dumsong); **Sikkim** (Rimbi Chhu). On moss-covered trees; 1660–2300m. Fl. September–October.

GENERAL DISTRIBUTION. NW Himalaya, Nepal and NE India.
ETYMOLOGY. From the Latin *viridis* (green) and *-florus* (flowered).

Section **Cirrhopetalum** (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 259 (1861).

Garay, Hamer & Siegerist (1994) reconsidered the generic status of *Cirrhopetalum* and the genera of the *Bulbophyllum* alliance. They retained *Cirrhopetalum* as a distinct genus, proposing three sections, and introduced a number of new sections and new genera within the *Bulbophyllum* alliance. We have carefully noted their suggestions but feel that until a revision of the whole group has been undertaken we will treat all these plants under *Bulbophyllum*.

The sectional treatment of the *Cirrhopetalum* group also presents a problem. There are inconsistencies in all the versions we have seen and none is entirely satisfactory. We have here broadly followed Seidenfaden (1973b) but consider that the appearance of the dorsal sepal margin is a somewhat variable and unhelpful character for sectional delimitation. In addition, examination of herbarium material may result in significant inconsistencies and errors because some species have tepal margins that are very finely erose, papillose or ciliate and these features can be obscured by drying. We have therefore divided the group into two general alliances:

Group 1 having petals with erose to ciliate margins, or with paleae on the margins.

Group 2 having petals with entire, glabrous margins.

Whilst these divisions have the advantage of consistency, we are not suggesting that they have any phylogenetic significance.

Group 1

39. **B. amplifolium** (Rolfe) N.P. Balakrishnan & S. Chowdhury in Bull. Bot. Surv. Ind. 9: 89, t.14 (1967). Types: China, NW Yunnan, *Forrest* 958 (syn. E!); Yunnan, *Forrest* 970 (syn. E!); SW China, *Forrest* 1117 (syn. E!).
Cirrhopetalum amplifolium Rolfe in Notes Roy. Bot. Gard. Edinburgh 8(36): 21, t.10 (1913).

Plant epiphytic or lithophytic, erect, 30–45cm tall; *rhizome* creeping. *Pseudobulbs* cylindric-ovoid, angled, shining, 6–8cm tall, inserted at intervals of c.9cm along rhizome. *Leaf* 1, coriaceous, elliptic to elliptic-oblong, subobtuse, 15–20 × 7–8.5cm; petiole 4–6cm long. *Inflorescence* suberect, 15–30cm tall, umbellately 4- to 8-flowered; peduncle glabrous, sheathed; sheaths 3 or 4, distant, tubular-lanceolate; floral bracts lanceolate to oblong-lanceolate, acuminate, concave, 0.8–1.3cm long. *Flowers* uniformly yellowish-pink, veined with deep purple; pedicel and ovary slender, 1.5–2cm long. *Dorsal sepal* ovate, concave, apex long-setiform, margins minutely crenulate, c.1cm long; setae slender, flexuose, c.8mm long; *lateral sepals* connivent to just below apex, apex shortly 2-dentate, 4.5–5.5cm long. *Petals* ovate-triangular, margins long-toothed, apex long-setiform, c.4mm long; *setae* slender, flexuose, c.9mm long. *Lip* recurved, simple, fleshy, ovate-oblong, obtuse, c.6mm long. *Column* stout, c.3mm long; stelidia incurved, falcate, oblong, apiculate, c.4mm long.

Bhutan: C – Tashigang district (near Tashi Yangtsi (M.F.B.)). In shade on trees and cliffs; 1800m. Fl. October–November.

GENERAL DISTRIBUTION. NE India, Myanmar and China (Yunnan).
ETYMOLOGY. From the Latin *amplus* (large) and *-folium* (leaved).
NOTE. This species is closely related to *B. picturatum* (Loddiges) Rchb. f.

40. **B. andersonii** (Hook. f.) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2(8): 22 (1912). Type: India, Sikkim Himalaya near Darjeeling, *T. Anderson*, icon. by L. Singh (holo. CAL, copy K!).
Cirrhopetalum andersonii Hook. f., Fl. Brit. India 5(2): 777 (1890); Icon. Pl. 21: 2055 (1892).
Phyllorchis andersonii (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).
Cirrhopetalum henryi Rolfe in J. Linn. Soc., Bot. 36: 15 (1903). Type: China, Yunnan, Mengtze, *Henry* 11264 (holo. K!, iso. LE!).
Bulbophyllum henryi (Rolfe) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2(8): 25 (1912).
Cirrhopetalum rivesii Gagnepain in Bull. Soc. Bot. France 78: 7 (1931). Type from Vietnam.

Plant epiphytic; *rhizome* sheathless, brown; *roots* clustered at pseudobulb base. *Pseudobulbs* ellipsoid to ovoid, smooth, fibrous at base, 2.-3.5 × 0.4–0.6cm, inserted at intervals of 3.5–6cm along rhizome. *Leaf* 1, oblong to linear-oblong, apex subacute to emarginate, narrowed at base, 9–13(–16.5) × 2–3.5(–4)cm; petiole channelled, 2cm long. *Inflorescence* basal from pseudoblb base, erect, umbellate, 5- to 10-flowered; peduncle slender, glabrous, sheathed, green with purple spots, 12–16(–19.5)cm long; sheaths 2, distant, lanceolate-oblong, acute, wide mouthed above, tubular at base, 0.7–1cm long; *floral bracts* lanceolate, acute to acuminate, 1-veined, 4–5 × 1–1.5mm. *Flowers* dorsally compressed, 1–1.5cm long; sepals, petals and lip pink with minute darker pink-purple spots; pedicel and ovary slender, glabrous, 0.7–1.1cm long. *Dorsal sepal* oblong-ovate, apex linear, boat-shaped, 5-veined, margins minutely dentate, 4–6 × 2–2.5mm; *lateral sepals* oblong-obovate, falcate, obtuse, 5-veined, outer margins connivent for three-quarters of length, 1.5–2.2 × 0.4–0.6cm. *Petals* broadly oblong, acute to linear, 3-veined, margins weakly erose, 3–4 × 1.5–2mm. *Lip* simple, decurved centrally, narrowly oblong, apex obtuse, emarginate, margins entire, 4–5 × 1.6–2mm. *Column* stout, 2mm long; stelidia triangular, acute; foot curved; anther cap toothed.

Sikkim (Tista Valley (King & Pantling, 1898), Tong). 500–700m. Fl. September–October.

GENERAL DISTRIBUTION. NE India, China, Myanmar and Vietnam.

ETYMOLOGY. Named after Thomas Anderson (1832–1870), Superintendent of the Calcutta Botanic Garden and collector of the type specimen.

NOTE. Seidenfaden (1973b) discussed the taxonomy of this species.

41. **B. appendiculatum** (Rolfe) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 8: 22 (1912). Type: India, Sikkim, *Pantling* 197 (holo. CAL, iso. BM! K!).

Cirrhopetalum appendiculatum Rolfe in Bull. Misc. Inform. Kew 1901: 148 (1901).

C. ornatissimum sensu Hook. f., Fl. Brit. India 5(2): 773 *p.p.* (1890), *non* Rchb. f.

Mastigion appendiculatum (Rolfe) Garay, Hamer & Siegerist in Nordic J. Bot. 14: 637 (1994).

Plant epiphytic; *rhizome* creeping, sheathless, 1.5–2mm thick; *roots* caespitose from pseudobulb base. *Pseudobulb* cylindric to ellipsoid, ribbed, 2–3 × 0.4–0.6cm, inserted at intervals of 1.5–2.5cm along rhizome. *Leaf* 1(–2), coriaceous, oblong-elliptic, emarginate, sessile or very shortly petiolate, 5–6.5 × 1.2–2.1cm; petiole 1–2mm long. *Inflorescence* erect, basal, 1-flowered; peduncle sheathed, 7–8cm long; sheaths lanceolate, c.1cm long; floral bract lanceolate, acuminate, keeled, 1.1–1.3 × 0.1–0.15cm. *Flower* unpleasantly scented, 10–12cm long; dorsal sepal and petals yellow, veined with purple, lateral sepals speckled with red-purple, lip pinkish-purple with dark purple margins, spotted; pedicel and ovary 1.6–1.7cm long. *Dorsal sepal* ovate, concave, caudate, 3-veined, margins pilose-setiform, c.1 × 0.5cm; *lateral sepals* free at base, attached to base of column foot, widely separated from dorsal sepal, connivent centrally, twisted, lanceolate, apices free, caudate-filiform, 10–12 × 0.2–0.3cm (at base). *Petals* linear to linear-oblong, falcate, acuminate, 1-veined, margins setose, c.6 × 1.5mm. *Lip* adnate to apex of column foot, simple, fleshy, glabrous, ovate-oblong, obtuse, margins erect, base concave, 6–7 × 2.5–3mm; disc 3-keeled, glabrous. *Column* stout, c.4 × 2.5mm; stelidia 2, linear, decurved; foot long, curved, 7–9mm long; anther cap pubescent.

Sikkim (unlocalised *Pantling* and *Togashi* specimens). In tropical valleys: 330m. Fl. October–November.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. From the Latin *appendiculatus* (with a small appendage) in reference to the apex of the dorsal sepal.

NOTES. Seidenfaden (1973b) included the Sikkim plants under *B. putidum* (Teijsmann & Binnendijk) J.J. Smith. Garay, Hamer & Siegerist (1994) separated the Sikkim plants as *Mastigion appendiculatum*, a position then followed by Seidenfaden (1995a). We believe this identification to be correct but retain the species under *Bulbophyllum*.

42. B. emarginatum (Finet) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 8: 24 (1912). Type: China, Yunnan, Tsekou. *d'Orleans* s.n. (holo. P).

Cirrhopetalum emarginatum Finet in Bull. Soc. Bot. France 44: 269, t.8 (1897).

Bulbophyllum brachypodum A.S. Rao & N.P. Balakrishnan in Bull. Bot. Surv. India 10(3–4): 350 (1968).
Type: Bhutan, Tashiyangtsi, *Balakrishnan* 44298 (holo. ASSAM).

B. brachypodum var. *geei* A.S. Rao & N.P. Balakrishnan, *loc. cit.* (1968). Type: India, Kameng, E.P. *Gee* 43067 (holo. ASSAM).

Plant epiphytic; *rhizome* creeping, sparsely sheathed, 1–2.5mm thick; *roots* filiform, from pseudobulb base. *Pseudobulbs* conical-pyriform, rugose when dry, erect, sheathed, 2–3 × 0.5–0.7cm, inserted at intervals of 3–9.5cm along rhizome; sheaths broadly lanceolate-ovate, acute, 1.5–2 × 0.6–0.9cm. *Leaf* 1, linear-oblong to linear-ovate, obtuse, retuse to emarginate, dorsal vein keeled, 3.5–8.5 × 1.1–2.2cm; petiole channelled, 3–5mm long. *Inflorescence* basal from pseudobulb, erect, umbellate, 2- or 3-flowered; peduncle filiform, sheathed at base, sparsely warty, 2.8–3.5cm long; sheaths 2, overlapping, tubular, 6–8mm long; floral bracts lanceolate, papery, 6–8 × 1–2mm. *Flowers* pendent, resupinate, 3.5–5cm long; sepals purple with darker stripes, petals white striped purple, lip purple; pedicel and ovary filiform, 1.8–2.2cm long. *Dorsal sepal* lanceolate to wedge-shaped, 7-veined, truncate-retuse, upper margins shortly pubescent, 1.5–1.6 × 0.5–0.7cm; *lateral sepals* spreading, base free, connivent above, veins glabrous, apices free, caudate-acuminate, base oblong-oblique, 3.5–5 × 0.6–0.9cm (at base). *Petals* subquadrate, 3-veined, apex pubescent, 7–9 × 5–6cm. *Lip* simple, jointed with apex of column foot, subtriangular, obtuse, apex recurved, margins revolute, 0.9–1.2cm long; disc 2-lamellate. *Column* stout, c.4 × 2.5mm; stelidia 2, triangular, linear; foot curved, 5–6mm long.

Bhutan: C – Punakha district (Lamperi, Lometsawa). In rain forest on a narrow open ridge; 1700–2600m. Fl. October–December.

GENERAL DISTRIBUTION. NE India, Myanmar, China (Xizang, Yunnan) and Vietnam.

ETYMOLOGY. From the Latin *emarginatus* (shallowly notched) in reference to the leaf apex.

NOTES. *B. emarginatum* is closely related to *B. yoksunense* but is a larger flowered plant. Seidenfaden (1973b) discussed the possibility of treating them both as varieties of *B. emarginatum*, but later authors have treated them as separate species and we follow them here. Garay, Hamer & Siegerist (1994) placed this and *B. yoksunense* in a new section *Emarginatae*.

43. B. helenae (Kuntze) J.J. Smith in Bull. Jard. Bot. Buitenzorg 2(8): 24 (1912). Type: India, Khasia, Nungclow, *Gibson* s.n. [with icon.] (holo. K-LINDL!).

Cirrhopetalum cornutum Lindl. in Bot. Reg. 24: misc.75, no.138 (1838).

Bulbophyllum cornutum sensu (Lindl.) Rchb. f. in Walpers, Ann. Bot.Syst. 6: 261 (1861), non (Bl.) Rchb. f. (1861).

Phyllorchis helenae Kuntze, Revis. Gen. Pl. 2: 676 (1891).

Rhytionanthos cornutum (Lindl.) Garay, Hamer & Siegerist in Nordic J. Bot. 14(6): 637 (1994).

Plant epiphytic; *rhizome* short, fibrous-sheathed, 3–5mm thick; *roots* densely caespitose. *Pseudobulbs* clustered, ovoid-cylindric, compressed, 2–3.5 × 0.6–1.1cm, inserted at intervals of 0.3–2.5cm along rhizome. *Leaf* 1, linear-oblong to oblong-elliptic, obtuse, obliquely retuse, 12.5–22 × 1.7–3.1cm; petiole channelled, 2–3.5cm long. *Inflorescence* basal from pseudobulb or rhizome, suberect, umbellate, 6- to 9-flowered; peduncle slender, sheathed, glabrous, 10–19cm long; basal sheaths overlapping, tubular, 0.9–1.2cm long, upper ones distant, 0.8–1cm long; floral bracts narrowly lanceolate, acute, 4–5 × 0.5–1mm. *Flowers* unpleasantly scented, 1–2.5cm long; dorsal sepal yellow with red-purple spots, lateral sepals yellow-red, spotted with red, petals yellowish-white spotted with red, lip deep red with yellow;

pedicel and ovary slender, glabrous, 5–9mm long. *Dorsal sepal* ovate, subacute to acute, hooded over column, scabrid, margins entire to minutely serrate, 3-veined, 3.5–5 × 1.8–2mm; *lateral sepals* narrowly lanceolate, falcate, acuminate, connivent centrally, free at base and apex, shortly ciliate, 2–3.5 × 0.2–0.3cm. *Petals* ovate, acute, 3-veined, ciliate-dentate, 1.5–1.6 × 1–1.2mm. *Lip* simple, thick, oblong, subacute, deflexed from base, 3–4 × 0.8–1mm; disc 2-lamellate. *Column* broad, 1–1.5mm tall; stelidia 2, erect, acute; foot curved, 1–1.5mm long; anther cap papillose, c.0.75mm across. *Fruit* ovoid-cylindric, stalked, 1.5–1.8 × 0.4–0.6cm. **Plate 25**.

Bhutan: **S** – Sarbhang district (Noonpani); **N** – Upper Mo Chu district (Gasa); **Sikkim** (unlocalised *Pantling* specimens). 830–2660m. Fl. (March–)May–August.

GENERAL DISTRIBUTION. NW India, Nepal, NE India, Myanmar and Thailand.
ETYMOLOGY. Not known.
NOTES. *B. cornutum* (Bl.) Rchb. f. is based upon *Ephippium cornutum* Bl. and therefore predates *B. cornutum* (Lindl.) Rchb. f. The correct name for the species is therefore *B. helenae* (Kuntze) J.J. Smith as used by Seidenfaden (1973b). *B. forrestii* Seidenfaden is closely related to this species but differs in having a subumbellate inflorescence and a glabrous dorsal sepal. We have found that this character is rather variable (particularly in herbarium material) and remain unsure as to whether or not these species should be kept distinct. Further examination of living material will be required to resolve this problem.

44. **B. rothschildianum** (O'Brien) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 8: 27 (1912). Type: India, Darjeeling, cult. O'Brien s.n. (holo. K!).
Cirrhopetalum rothschildianum O'Brien in Gard. Chron. ser.3, 18: 608 (1895).

Plant epiphytic; *rhizome* sheathed. *Pseudobulbs* not seen [ovoid-pyriform, distant on rhizome]. *Leaf* not seen [1, oblong, emarginate, sessile to shortly petiolate]. *Inflorescence* erect, umbellate, 2- or 3-flowered; pedicel glabrous, sheathed, 9.5–16 × 0.3cm; sheaths distant by c.6.8cm, tubular, 1–1.2cm long; floral bracts narrowly lanceolate, acuminate, 1.1–1.2 × 0.1–0.2cm. *Flowers* 9–11cm long; dorsal sepal and petal green with purple veins and fringing, lateral sepals crimson-purple, blotched with yellow-green, lip purple, column green; pedicel and ovary glabrous, 1.7–1.9cm long. *Dorsal sepal* lanceolate, acuminate, hooded, margins long-fimbriate, 5-veined, warty externally, 1–1.1 × 0.5–0.6cm; *lateral sepals* oblong below, tapering to long filiform-caudate apex, warty at base, 5-veined, outer margins connivent centrally, 8–11 × 0.8–0.9cm. *Petals* triangular-lanceolate, acuminate, falcate, margins long-fimbriate, 3-veined, 0.8–1 × 0.25–0.3cm. *Lip* simple, adnate to apex of column foot, ovate-oblong, narrowed to obtuse apex, margins erect and pilose-pubescent, grooved centrally, 6–8 × 2.5–3.5mm. *Column* stout, shortly winged, 4 × 2mm; stelidia 2, linear; foot curved, 0.9–1.2cm long.

Darjeeling (unlocalised specimen).

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. Named after Lionel Walter Rothschild, 2nd Baron (1868–1937) of Tring Park, England who exhibited and won a First Class Certificate with this species at the Royal Horticultural Society.
NOTE. Seidenfaden (1973b) discussed the similarity of this species to *B. wendlandianum* (Kränzlin) U. Dammer and considered the possibility that this was a tetraploid form of that species.

45. **B. roxburghii** (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 263 (1861). Type: India, Ganges delta, [icon. of] '*Aerides radiatum*' Roxburgh 2351 (holo. K!, iso. CAL).
Cirrhopetalum roxburghii Lindl., Gen. Sp. Orchid. Pl.: 58 (1830).
Aerides radiatum Roxb., Fl. Ind. ed. 1832, 3: 476 (1832). Type: India, Ganges Delta, *Carey* s.n. (lecto. [icon. of] '*Aerides radiatum*' Roxburgh 2351 K!), designated by Hooker, Icon. Pl.: t.2057 (1892).
Cirrhopetalum sikkimense King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 90, t.125 (1898), **syn. nov.** Type: India, Sikkim, *Pantling* 148A (holo. CAL, iso. AMES! L! P).
Bulbophyllum sikkimense (King & Pantling) J.J. Smith, Rev. Gen. 2(8): 28 (1912), **syn. nov.**

Plant epiphytic, 7–8cm tall; *rhizome* sheathless or sparsely sheathed, 1.5–2mm thick; *roots* few from pseudobulb base. *Pseudobulbs* ovoid-globose, fibrous-sheathed, 0.6–1.2 × 0.5–0.6cm, inserted at intervals of 1.5–3cm along rhizome. *Leaf* 1, coriaceous, oblanceolate, obtuse, obliquely emarginate, sessile to shortly petiolate, 3–4.2 × 1.1–1.4cm; petiole 4–5mm long. *Inflorescence* basal from pseudobulb, slightly exceeding leaves, umbellately 5- to 12-flowered; peduncle slender, suberect, sheathed at base and above, 6–7cm long; sheaths lanceolate, acute, 5–6 × 1–2mm; floral bracts lanceolate, acuminate, 3–3.2 × 0.5–0.75mm. *Flowers* 6–9mm long; dorsal sepal greenish with brown-red markings, lateral sepals ochre, minutely spotted with red-brown, petals ochre with red-brown veins, lip ochre; pedicel and ovary slender, 3–5mm long. *Dorsal sepal* free, ovate, acute-aristate, concave, margins finely long ciliate-setose, 2.2–2.5 × 1–1.2mm; *arista* 2–2.2mm long; *lateral sepals* narrowly oblong, obtuse, weakly falcate, connivent, free at base, 8–9 × 1.5–2mm. *Petals* ovate, 3-veined, margins ciliate-aristate, subacute, base oblique, 2–2.2 × 0.8–1mm; *arista* 0.8–1mm. *Lip* simple, broadly ovate, narrowed to acute apex, margins entire, 2–2.5mm long. *Column* broad, 1–1.3mm long; stelidia 2, triangular, acute; foot curved.

Sikkim (Tista River Valley). In tropical valleys; 330m. Fl. June.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named after William Roxburgh (1751–1815), Superintendent of the Calcutta Botanic Garden between 1793 and 1813.

NOTE. Rolfe (1903) and Seidenfaden (1973b) discussed the taxonomic problems of *B. roxburghii* and *B. sikkimense*. We have studied the limited material available and agree with Seidenfaden (1973b) that the plants are indistinguishable.

46. B. scabratum Rchb. f. in Walpers, Ann. Bot. Syst. 6: 259 (1861). Type: E Indies, without precise locality, cult. Duke of Devonshire s.n. (holo. K-LINDL!).

Cirrhopetalum caespitosum Wall. ex Lindl. in Bot. Reg. 24: misc.35, no.53 (1838). Type without provenance, cult. (holo. K-LINDL!).

Bulbophyllum confertum Hook. f., Fl. Brit. India 5(2): 757 (1890); Icon. Pl. 21: t.2035 (1890). Type: India, Khasia, *Griffith* 5170 (holo. K!).

Plant epiphytic, 7–12cm tall; *rhizome* attenuate; *roots* filiform. *Pseudobulbs* caespitose, narrowly conical-ovoid, erect to curved, fibrous-sheathed, 1.1–1.3 × 0.2–0.6cm. *Leaf* 1, linear-oblong, subacute to acute, strongly keeled beneath, 5–8 × 0.6–1cm; petiole 0.8–1.2cm long. *Inflorescence* basal, erect, shorter than leaves, subumbellately 3- to 5-flowered; peduncle filiform, sheathed at base and above, glabrous, 2–3.5cm long; sheaths lanceolate, mouth wide, 5–6mm long; floral bracts lanceolate, acuminate, 3–4 × 0.8–1mm. *Flowers* 0.6–1.2cm long, uniformly pale yellow-ochre; pedicel and ovary slender, glabrous, 5–7mm long. *Dorsal sepal* free, ovate, acuminate, concave, hooded, 3-veined, minutely scabrid, 3–5 × 1.5–2mm; *lateral sepals* linear-lanceolate, obtusely acuminate-caudate, connivent at base, 3-veined, minutely scabrid, 11–12 × 0.25–0.5mm (1.5–2mm at base). *Petals* broadly ovate, acute, margins erose-dentate, 3-veined, 2–3 × 1–2mm. *Lip* simple, fleshy, oblong, subacute, margins entire, 1.5–1.6 × 0.4–0.5mm. *Column* thick, 0.8mm long; stelidia 2, triangular; foot curved, 1–1.5mm long. *Fruit* globose, stalked, 0.9–1 × 0.3–0.5cm. **Plate 26.**

Bhutan: S – Gaylegphug district (Gaylegphug); **Sikkim** (Chunthang). 2000m. Fl. March–May; Fr. December.

GENERAL DISTRIBUTION. Nepal and NE India.

ETYMOLOGY. From the Latin *scaber* (rough or gritty) in reference to the surface of the sepals and petals.

NOTE. When Reichenbach transferred *Cirrhopetalum caespitosum* to *Bulbophyllum* he had to coin a new name as *B. caespitosum* Thouars had already been used for an African species.

47. B. yoksunense J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 8: 29 (1912). Type: India, Sikkim, between Yoksun and Jongri, *T. Anderson*, icon. by L. Singh (holo. CAL, copy of icon. K!).

Cirrhopetalum brevipes Hook. f., Fl. Brit. India 5(2): 777 (1890); Icon. Pl. 21: t.2056 (1892). Type: India, Sikkim, Yoksum, *T. Anderson* (holo. CAL).

Phyllorchis brevipes (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 678 (1891).

Bulbophyllum brachypodum var. *parviflorum* A.S. Rao & N.P. Balakrishnan in Bull. Bot. Surv. India 10(3–4): 350 (1968). Type: Bhutan, Gumdrithang, *Balakrishnan* 43004 (holo. CAL, iso. ASSAM).

Plant epiphytic; *rhizome* long, branched, sheathed at intervals, c.1mm thick; sheaths tubular, 0.8–1cm long; *roots* from pseudobulb base. *Pseduobulbs* cylindric, curved, smooth, sheathed, 1.7–3.5 × 0.2–0.4cm, inserted at intervals of 4.5–9cm along rhizome; sheath broadly ovate, acute, membranous, 1.6–2 × 0.7–1.2cm. *Leaf* 1, coriaceous, elliptic-oblong, obtuse, retuse, base sessile to shortly petiolate, vein keeled beneath, 3–4.5 × 0.8–1.8cm; petiole 0.1–4mm long. *Inflorescence* basal from pseudobulb, arising from within sheath, racemose to subumbellate, 6- to 12-flowered; peduncle stout, glabrous, sheathed at base, 1.2–1.5cm long; floral bracts linear, acute, spreading, 3-veined, 6–7 × 0.8–1.2mm. *Flowers* dorsally depressed, 1.2–1.5cm long; sepals and petals pale pink on a white base, purple-striped, lip purple; pedicel and ovary slender, 6–8mm long. *Dorsal sepal* ovate-oblong, 5-veined, acute, margins entire, 7–8 × 1.5–2mm; *lateral sepals* oblong-lanceolate, acuminate, 7-veined, connivent with free apices, 0.9–1.5 × 0.25–0.5cm. *Petals* broadly ovate, obtuse, 3-veined, margins densely ciliate, 2.5–4 × 1.5–2mm. *Lip* simple, attached to apex of column foot, ovate-oblong, obtuse, deflexed centrally, 2–3 × 1–1.5mm. *Column* stout, c.1.5mm tall; stelidia short, linear; foot curved, 2–2.5mm long.

Bhutan: C – Tashigang district (between Rocha Chu and Tashi Yangtsi); **Darjeeling** (unlocalised *Griffith* specimen); **Sikkim** (Chunthang, Khedum, Lachen Valley, Yoksam). In subtropical mixed forest, on oak trees; 2000–2660m. Fl. September–October.

GENERAL DISTRIBUTION. Nepal and NE India.

ETYMOLOGY. Named after Yoksun (Yoksam), a village in Sikkim, where the type specimen was discovered.

Section **Cirrhopetalum**

Group 2

48. B. elatum (Hook. f.) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 8: 23 (1912). Types: India, Darjeeling, *Gamble* 10560 (syn. K!); Sikkim, Rungbee, *Clarke* 12353 (syn. K!).

Cirrhopetalum elatum Hook. f., Fl. Brit. India 5(2): 775 (1890); Icon. Pl. 21: t.2052 (1891).

Phyllorchis elata (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

Plant epiphytic; *rhizome* covered by fibrous sheaths when old, 4–5mm wide; *roots* clustered at pseudobulb base. *Pseudobulbs* conical-cylindric to long-cylindric, tapered towards apex, 3–6 × 1.4–2cm, inserted at intervals of 1cm or less along rhizome. *Leaf* 1, oblong to narrowly-oblong, apex emarginate, 9.5–12 × 1.9–3.1cm; petiole channelled, 1–2.3cm long. *Inflorescence* basal from pseudobulb, tall, decurved, umbellate, densely many-flowered; peduncle slender, sheathed, glabrous, 18–32cm tall; sheaths 3, distant, lanceolate, tubular at base, 1.8–2cm long; floral bracts narrowly lanceolate, acute to subacuminate, 5–7 × 1–1.5mm. *Flowers* 1.5–2.5cm long; sepals and petals dull brown-ochre or dull green spotted with purple, lip yellow-ochre to yellow, column yellow; pedicel and ovary slender, glabrous, 1.5–2cm long. *Dorsal sepal* broadly ovate, subacute, depressed, hooded, 5-veined, 7–9 × 2.5–3mm; *lateral sepals* narrowly oblong, falcate, subacute, free, 5-veined, 1.6–2 × 0.25–0.4cm. *Petals* falcately triangular to oblong, 3-veined, base oblique, 4–7 × 1.5–2.5mm. *Lip* simple, oblong, tapering to subacute apex, entire, upper surface grooved in lower half, 3.5–4 × 1–1.5mm. *Column* obscurely winged, 2–3mm tall; stelidia minute, decurved; foot slender, curved, 3–4mm long. Fruit narrowly cylindric, stalked, 3–5 × 0.5–0.7cm; stalk 1.5–2cm long. **Plate 25.**

Bhutan: S – Chukka district (E facing slopes above Chukka Dzong); **Darjeeling** (unlocalised *Gamble* specimens); **Sikkim** (Chunthang, Rimbi Chhu, Tendong). In mixed broad-leaved forest; 1660–2500m. Fl. June–August; Fr. July–September.

GENERAL DISTRIBUTION. Nepal and NE India.

ETYMOLOGY. From the Latin *elatus* (tall) in reference to the plant's size.

NOTE. Garay, Hamer & Siegerist (1994) proposed section *Elatae* for this and related species.

49. **B. guttulatum** (Hook. f.) N.P. Balakrishnan in J. Bombay Nat. Hist. Soc. 67: 66 (1970). Types: Nepal, *Wallich* s.n. (syn. BM!); India, Sikkim, *Hooker* 32 (syn. K-LINDL!).

Bulbophyllum umbellatum sensu Lindl. in Bot. Reg. 31: t.44 (1845), non Lindl. (1830).

Cirrhopetalum guttulatum Hook. f., Fl. Brit. India 5(2): 776 (1890).

Plant epiphytic; *rhizome* slender; *roots* clustered from pseudobulb base. *Pseudobulbs* conical-ovoid, erect, green, 3–4.5 × 1–1.5cm, inserted at intervals of 1–2cm along rhizome. *Leaf* 1, oblong to oblong-elliptic, obtuse, minutely retuse, 8.5–16 × 2.1–3.3cm; petiole channelled, 2–2.5cm long. *Inflorescence* basal from pseudobulb, erect-curved, umbellate, 5- to 7-flowered; peduncle exceeding leaf, slender, sheathed, glabrous, 16–25cm long; sheaths distant, tubular, 0.7–1.1cm long; floral bracts lanceolate, acuminate, 5–7 × 1–1.7mm. *Flowers* 1–1.8cm long; sepals and petals green-yellow with fine purple spots, lip purple-pink on a white base with darker purple spots, column green-yellow; pedicel and ovary slender, glabrous, 1.3–1.5cm long. *Dorsal sepal* broadly ovate, obtuse, 5-veined, 0.6–1 × 0.4–0.5cm; *lateral sepals* ovate-lanceolate, broadly based, acute to acuminate, 7-veined, free, adnate to column foot, 1.4–1.8 × 0.45–0.6cm. *Petals* ovate, obtuse, 3-veined, 3–5 × 1.5–2mm. Lip simple, fleshy, broadly oblong, deflexed centrally, base broad, 3–4 × 1–2mm; disc keeled. Column broad, 1–1.5mm long; stelidia caudate, 1.5–2.5mm long; foot slender, 3.5–4.5mm long. Fruit ovoid, stalked, c.5 × 1.8cm.

Bhutan: N – Upper Mo Chu district (Gasa); **Darjeeling** (Kalimpong); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). 1000–2660m. Fl. August–September.

GENERAL DISTRIBUTION. Nepal, NE India and Vietnam.

ETYMOLOGY. From the Latin *guttulatus* (spotted) in reference to the sepals and petals.

NOTE. This species is related to B. *umbellatum* but differs in having spotted flowers, an inflorescence that is longer, rather than shorter, than the leaves and long-caudate stelidia.

50. **B. muscicola** Rchb. f. in Flora 55: 275 (1872). Type: E Himalaya, Assam, *Mann* s.n. (holo. W! Herb. no. 49454).

Cirrhopetalum wallichii Lindl., Gen. Sp. Orchid. Pl.: 59 (1830), non Lindl. (1839). Type: Nepal, icon. Wallich 1131 (holo. K!).

C. hookeri Duthie in J. Asiat. Soc. Bengal 71(2): 38 (1902). Type: India, W Himalaya, Tehri-Garhwal, *Mackinnon's collector* 25402 (holo. K!, iso. AMES).

Bulbophyllum hookeri (Duthie) J.J. Smith in Bull. Jard. Bot. Buitenzorg sér.2(8): 25 (1912).

B. wallichii sensu (Lindl.) Merrill & Metcalf in Lingnan Sci. J. 21(1–4): 7 (1945), non. Rchb. f. (1861).

Plant epiphytic; *rhizome* fibrous-sheathed, c.1mm thick; *roots* filiform, from pseudobulb base. *Pseudobulbs* globose-ovoid, weakly rugose, 1.3–1.7 × 0.9–2cm, inserted at intervals of 0.7–1.2cm along rhizome. *Leaf* 1, linear-oblong to oblong, obtuse to retuse, 2.5–3.7 × 0.7–1cm; petiole 1.5–2mm long. *Inflorescence* basal, erect, umbellate, 3- to 6-flowered; peduncle slender, glabrous, sheathed, 4–6cm tall; sheaths distant, lanceolate-tubular, 0.7–1cm long; floral bracts lanceolate, acute, 1-veined, 4–5 × 0.8–1.2mm. *Flowers* 0.7–1.9cm long; dorsal sepal orange-yellow flushed with purple, purple veined, lateral sepals orange, purple veined, petals yellow, flushed with purple at base, lip yellow, spotted with purple, column yellow, flushed with purple at base; pedicel and ovary slender, glabrous, 5–7mm long. *Dorsal sepal* oblong-elliptic, obtuse, entire, 3-veined, 3–4 × 1–1.7mm; *lateral sepals* oblong-lanceolate, tapering to acute apex, connivent variably from base to apex, 3-veined, 1.5–1.9 × 0.1–0.2cm. *Petals* elliptic, retuse, entire, 3–4 × 1.8–2.1mm. *Lip* simple, adnate to apex of column foot, decurved centrally, margins recurved, broadly triangular, 2–3.2mm long. *Column* broad, c.1 × 1.2mm; stelidia 2, triangular; foot curved, slender, c.2mm long.

Bhutan: C – Punakha district (between Lamperi and Lometsawa); **Darjeeling** (Dumsong); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). On *Rhododendron arboreum*; 1600–2000m. Fl. (September–)October(–December).

GENERAL DISTRIBUTION. India (NW Himalaya), E Himalaya and Nepal.

ETYMOLOGY. From the Latin *muscus* (moss) and *-cola* (dwelling), a reference to the plant's habitat.

NOTE. Seidenfaden (1973b) and Garay, Hamer & Siegerist (1994) discussed the confused taxonomy of this species and since the name *B. wallichii* is preoccupied by *B. wallichii* Rchb. f. (based on *Cirrhopetalum wallichii* Lindl. 1839) we cannot transfer *C. wallichii* Lindl. 1830 to *Bulbophyllum* and have therefore used the next validly published name for this species.

51. **B. retusiusculum** Rchb. f. in Gard. Chron. 1869: 1182 (1869). Type: Myanmar, Moulmein, cult. Benson, icon. Veitch (holo. W! Herb. no. 49477).
Cirrhopetalum retusiusculum (Rchb. f.) Hemsley in Gard. Chron. n.s. 18: 365 (1882).
Bulbophyllum langbianense Seidenfaden & Smitinand, Orchid. Thail. (Prelim. List): 798 (1965).
Cirrhopetalum confusum Garay, Hamer & Siegerist in Nordic J. Bot. 14(6): 622 (1994). Type: India, Sikkim, *Pantling* 337 (holo. K!).

Plant epiphytic; *rhizome* sheathless, 1–2mm thick; *roots* filiform, from pseudobulb base. *Pseudobulbs* ovoid-conical, weakly falcate, 1.2–1.9 × 0.4–1.4cm, inserted at intervals of 0.7–1.6cm along rhizome. *Leaf* 1, linear-oblong to oblong, subacute, obliquely retuse, base subsessile to shortly petiolate, 2.7–6.5 × 0.9–1.3cm; petiole channelled, 4–5mm long. *Inflorescence* basal from pseudobulb, erect, slender, umbellate, 6- to 12-flowered; peduncle filiform, sheathed, glabrous, 4.5–14cm long; sheaths distant, tubular-lanceolate, mouth wide, 7mm long; floral bracts narrowly lanceolate, acuminate, 4.5–7 × 0.4–0.5mm. *Flowers* 1.5–2.5cm long; dorsal sepal deep violet spotted with darker purple, lateral sepals pale brown or yellow-orange to pale yellow-white lined with red, petals deep violet, spotted, lip purple with yellow streaks, column brownish; pedicel and ovary slender, glabrous, 5–7mm long. *Dorsal sepal* oblong-ovate, obtuse, 3-veined, 4–4.5 × 1–1.5mm; *lateral sepals* linear-oblong, acute, entire, connivent except at base and apex (separating with time), 3-veined, 2.2–2.3 × 0.3–0.35cm. *Petals* spreading, broadly elliptic, falcate, obtuse, 3-veined, 3.8–4 × 1.5–2mm. *Lip* simple, oblong, tapering to subacute apex, entire, decurved centrally, grooved at base, 2.5–3mm long. *Column* stout, winged, c.1.5mm long; stelidia 2, triangular, acute; foot curved, c.2mm long; anther cap papillose. **Fig. 102; Plate 25.**

Bhutan: C – Thimphu/Punakha (Henle La), Punakha (Menchunang), Tongsa (Tongsa) and Tashigang (Rocha Chu) districts; N – Upper Mo Chu district (Kencho); **Darjeeling** (unlocalised *Griffith* and *Hooker* specimens); **Sikkim** (Chunthang, Lachung, Rimbh Chhu, Yoksam). On *Rhododendron arboreum*, on *Quercus* sp., in temperate and subtropical mixed forest; 1000–2600m. Fl. July–October(–December).

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China, Thailand, Laos, Vietnam, Taiwan and Malaysia.

ETYMOLOGY. From the Latin *retusus* (with a rounded, shallowly notched tip) in reference to the leaf apex.

NOTES. This species, along with *C. wallichii* sensu Lindl. 1830, has caused great confusion over the years. Seidenfaden (1973b) treated *C. wallichii* sensu Lindl. 1830, along with its synonyms, as conspecific with *B. retusiusculum*. Garay, Hamer & Siegerist (1994) discussed the problem and retained them as separate species. We believe that the species are distinct and that plants with conical pseudobulbs should be

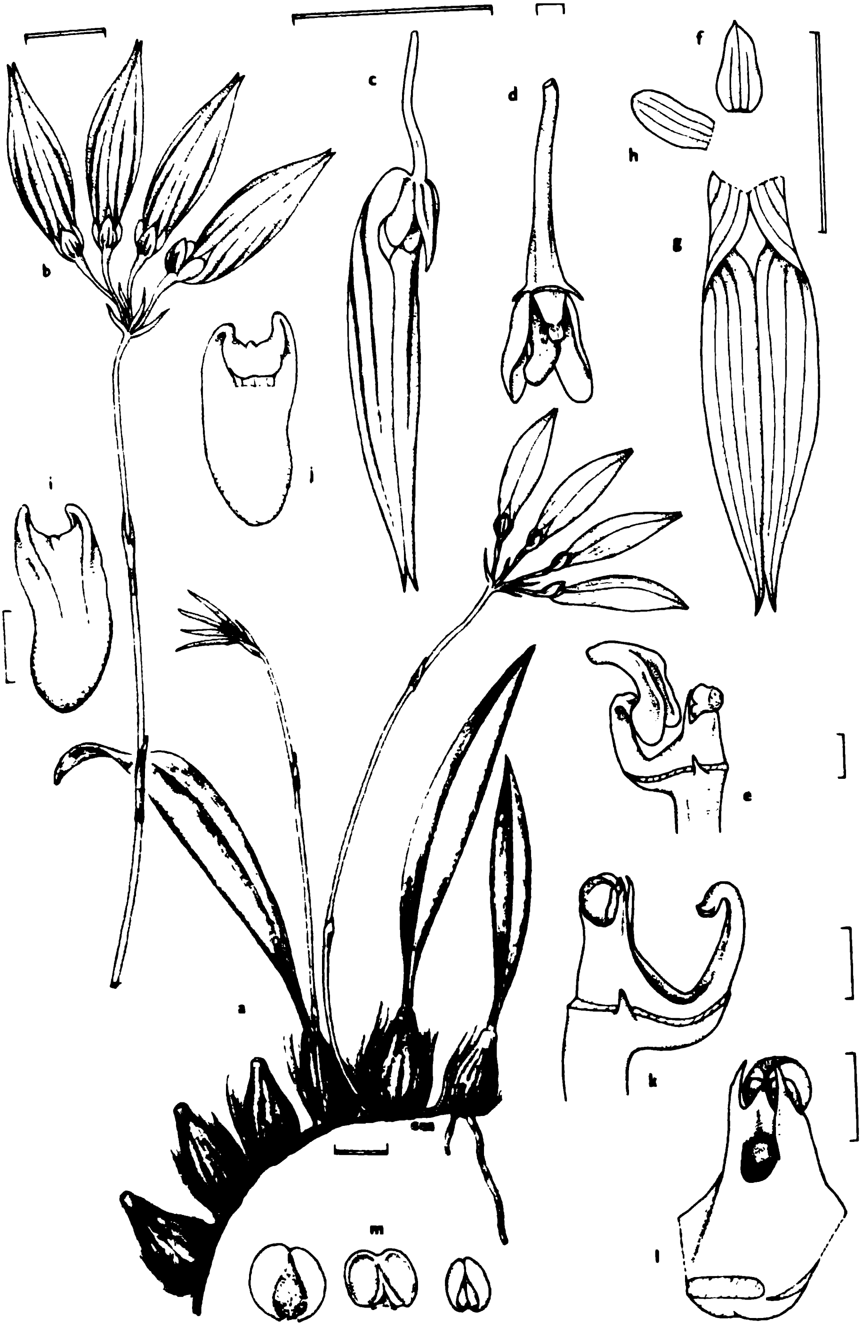

Fig. 102 ***Bulbophyllum retusiusculum***: a, habit; b, inflorescence; c, flower; d, flower (with lateral sepals removed); e, lip and column, f, dorsal sepal; g, lateral sepals; h, petal; i, lip (from above); j, lip (from below); k, column (side view); l, column, m, anther and pollinia Drawn by Susanna Stuart-Smith from *Grey-Wilson et al.* 4664 (K).

treated as *B. retusiusculum* and those with globose pseudobulbs (which are generally smaller) as *B. muscicola* Rchb. f.. Garay, Hamer & Siegerist (1994) described *C. confusum*, based on a Pantling collection from Sikkim, but we do not consider it to be distinct from *B. retusiusculum*.

52. **B. rolfei** (Kuntze) Seidenfaden in Dansk Bot. Ark. 33(3): 149 (1979). Type: India, Darjeeling, *Griffith* 5174 (holo. K!).
Cirrhopetalum parvulum Hook. f., Fl. Brit. India 5(2): 778 (1890); Icon. Pl. 21: 2060a (1891). Type: India, Darjeeling, *Griffith* 5174 (holo. K!).
Phyllorchis rolfei Kuntze, Revis. Gen. Pl. 2: 276 (1891).
Cirrhopetalum dyerianum King & Pantling in J. Asiat. Soc. Bengal 64(3): 335 (1896). Type: India, Sikkim, Tendong, *Pantling* 342A (holo. CAL, iso. BM! K!).
Bulbophyllum parvulum sensu J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2(8): 27 (1912), *non* Lindl. (1830).
B. dyerianum (King & Pantling) Seidenfaden in Dansk Bot. Ark. 29(1): 175 (1973).

Plant epiphytic, caespitose; *rhizome* 0.8–1mm thick; *roots* from pseudobulb base. *Pseudobulbs* ovoid to ovoid-falcate, 0.7–1.5 × 0.3–0.9cm, inserted at intervals of 0.1–2.4cm along rhizome. *Leaf* 1, oblong to oblong-elliptic, subacute, 2–5.3 × 0.8–1.2cm; petiole channelled, 3–5mm long. *Inflorescence* basal from pseudobulb, erect, shortly racemose, 3- or 4-flowered; peduncle slender, sheathed at base, glabrous, 4–5.5cm long; sheaths tubular-lanceolate, 1–1.2cm long; rachis 3–5mm long; floral bracts prominent, narrowly lanceolate, acuminate, 6–8 × 0.8–1mm. *Flowers* pendent, 6–8mm long; sepals and petals red-purple to yellow blotched with dark red-purple, lip deep red-purple; pedicel and ovary glabrous, 4–7mm long. *Dorsal sepal* oblong-ovate, acute, 3-veined, 5–6 × 1.5–2mm; *lateral sepals* linear-oblong, acuminate, weakly falcate, divergent, 3-veined, adnate at base only, 1.1–1.6 × 0.2–0.3cm. *Petals* ovate, acute, margins erose, 3-veined, 3.5–4.5 × 1–1.3mm. *Lip* simple, fleshy, narrowly oblong, tapering to subacute apex, decurved, upper surface grooved from base to apex, apex finely papillose, 3–4 × 0.5–0.8mm. *Column* 1–1.5mm tall; stelidia shortly dentate, erect; foot elongate, curved; anther cap papillose. *Fruit* ovoid, shortly stalked, 0.9–1.4 × 0.3–0.4cm. **Plate 26.**

Bhutan: C – Thimphu/Punakha (Dochu La), Punakha (Menchunang, Samtengang to Ritang, between Yuwak and Wangdi Phodrang) and Tongsa (between Tashiling and Chendebi, near Tongsa) districts; **Darjeeling** (unlocalised Griffith specimen); **Sikkim** (Lachung, Tendong Peak). On trunk of *Rhododendron arboreum*, in broad-leaved evergreen forest, on *Berberis* sp.; 2000–2750m. Fl. August–September; Fr. August–October.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. Named after Robert Rolfe (1855–1921) who was Assistant at the Kew Herbarium and a significant contributor to orchid taxonomy.

53. **B. sarcophylloides** Garay, Hamer & Siegerist in Nordic J. Bot. 14(6): 620 (1994). Type: India, Sikkim, Sivoke, *Pantling* 95A (holo. K!, iso. BM! W!).
Cirrhopetalum sarcophyllum var. *minor* King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 91 (1898).
Bulbophyllum sarcophyllum var. *minor* (King & Pantling) Hegde & A.N. Rao in Indian Forest., in press.

Plant epiphytic, pendent; *rhizome* slender, sheathless; *roots* caespitose. *Pseudobulbs* discoid, c.1.5 × 1.5mm, inserted at intervals of 4–7cm along rhizome. *Leaf* 1, ovate-elliptic to elliptic, subacute to minutely retuse, dorsally keeled, 4.1–6 × 1.7–2.5cm; petiole 4–8mm long. *Inflorescence* basal from pseudobulb, much shorter than leaves, c.2cm tall, umbellate, 5- or 6-flowered; peduncle glabrous, sheathed, c.1.4cm long; sheaths 2, basal, tubular-lanceolate, overlapping, mouth wide, 4–5mm long; floral bracts lanceolate, acute, dorsally keeled, c.3 × 0.5mm. *Fowers* 6–7mm long; sepals and petals reddish-brown, mottled with yellow, lip purplish, spotted with deeper purple; pedicel and ovary slender, 4–5mm long. *Dorsal sepal* ovate-lanceolate, acute, hooded, c.4 × 1.5mm; *lateral sepals* narrowly lanceolate, acute, connivent centrally for one third of length, base and apices free, glandular, c.7 ×

1.5mm. *Petals* oblong, falcate, acute, c.2.5 × 0.5mm. *Lip* simple, oblong, grooved centrally, c.2mm long. *Column* stout, c.1.3mm long; stelidia 2, long-filiform, c.0.9mm long; foot c.2mm long.

Darjeeling (Sibchu?, Sivok). 330–500m. Fl. May–June.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From a resemblance to *B. sarcophyllum*.
NOTES. King & Pantling (1898) described *B. sarcophyllum* var. *minor*, a smaller plant than the type variety found at lower elevations, with a short inflorescence and not connected by 'transitional forms'. Seidenfaden (1973b) included this variety within the synonymy of *B. sarcophyllum* but commented that the material he had seen was in bad condition. Some recent authors (Chowdhery, 1998) have retained it as a variety while Garay, Hamer & Siegerist (1994) treated it as distinct. Our description is based on the type material which is, indeed, in poor condition. This material is distinctive in having a strongly keeled, ovate-elliptic leaf, a very short inflorescence and a peduncle with bracts only at the base and for these reasons we follow Garay *et al.* here. Whether these features are sufficient to justify specific separation can only be answered by examination of further living collections.

54. **B. sarcophyllum** (King & Pantling) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 8: 27 (1912). Type: India, Sikkim, Rishap, *Pantling* 95 (holo. CAL).
Cirrhopetalum sarcophyllum King & Pantling in J. Asiat. Soc. Bengal. 64(3): 335 (1896).
Bulbophyllum panigrahianum S. Misra in Nordic J. Bot. 6(1): 25 (1986). Type: India, Orissa, Rimbeda, *S. Misra* 698 (holo. CAL, iso. K!).

Plant epiphytic; *rhizome* sheathless, c.1mm thick; *roots* slender, caespitose. *Pseudobulbs* discoid, compressed, fibrose at base, 2.5–4 × 2.5–3mm, inserted at intervals of 3.5–9cm along rhizome. *Leaf* 1, coriaceous, pendent, oblong-lanceolate, acute, weakly falcate, 6.5–11 × 1–1.8cm; petiole cylindric, 0.7–1.5cm long. *Inflorescence* pendent, 7–7.5cm tall, umbellate, 3- to 7-flowered; peduncle sheathed, 7–7.5cm long; sheaths distant, lanceolate, acute, 5–7mm long; floral bracts narrowly lanceolate, acute, 5–6 × 0.5–1mm. *Flowers* 1.5–2cm long; sepals and petals reddish-brown, mottled with yellow, lip purplish, spotted with deeper purple, column white, stelidia tips purple; pedicel and ovary slender, 3–5mm long. *Dorsal sepal* ovate-lanceolate, acute to acuminate, c.6 × 2mm; *lateral sepals* narrowly lanceolate, acute, connivent centrally for one third of length, base and apices free, glandular, 1.8–2 × 0.15–0.2cm. *Petals* oblong, falcate, acute, 2.5–3 × 1–1.5mm. *Lip* simple, oblong, grooved centrally, c.3mm long. *Column* stout, c.1.5mm tall; stelidia 2, filiform; foot c.2mm long.

Sikkim (unlocalised *Pantling* specimens). 1000m. Fl. September.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Greek *sarco-* (fleshy) and *phyllon* (leaf).

55. **B. spathulatum** (Rolfe ex Cooper) Seidenfaden in Bot. Tidsskr. 65: 347 (1970). Type: Thailand, unlocalised, *Roebelen* 292–12 (holo. K!).
Cirrhopetalum bootanense sensu Hook. f., Fl. Brit. India 5(2): 775 (1890), *non* Griff.
C. spathulatum Rolfe ex Cooper in Orchid Rev. 37: 106 (1929).
Rhytionanthos spathulatum (Rolfe ex Cooper) Garay, Hamer & Siegerist in Nordic. J. Bot. 14(6): 639 (1994).

Plant epiphytic, 7–13cm tall; *rhizome* sheathed, annulate, 1.5–2.5mm thick; *roots* short, caespitose. *Pseudobulbs* cylindric-ovoid, narrow, suberect to oblique, 2–3 × 0.6–0.9cm, inserted at intervals of 6–9cm along rhizome. *Leaf* 1, coriaceous, oblong-elliptic, obtuse to subacute, 4.3–7.8 × 1.2–2.1cm; petiole 4–8mm long. *Inflorescence* basal from pseudobulb, stout, subumbellately 5- to 8-flowered; peduncle sheathed, 2–3cm long; sheaths broadly tubular, overlapping, 5–9mm long; floral bracts oblong-ovate to lanceolate, acute, 0.9–1.2 × 0.22–0.4cm. *Flowers* ephemeral, compressed, 1.3–1.6cm long; sepals red-purple to pink, with darker spots, petals green-yellow with purple spots, lip purple with yellow green markings; pedicel and ovary slender, glabrous, 1.1–1.9cm long. *Dorsal sepal* broadly ovate, apiculate, concave, appressed to the column, surface weakly warty, 5-veined, 8 × 3mm; *lateral sepals* asymmetric, oblong, connivent to just below apex (blade subpanduriform to spathulate), apex bifid, margins entire, surface warty, the blade 1.2–1.7 × 0.5–0.8cm. *Petals* oblong, obtuse, falcate, 1-veined, 4–4.2 × 0.5–1mm. *Lip* simple, oblong, subacute, margins entire, base dilated, decurved centrally, grooved, 2–2.2mm long. *Column* broad, c.1.5mm tall; stelidia 2, triangular, acute; foot curved, c.2.5mm long.

Sikkim (unlocalised *Pantling* specimens). In tropical valleys. Fl. March.

GENERAL DISTRIBUTION. NE India, Myanmar, Thailand and Vietnam.
ETYMOLOGY. From the Latin *spathulatus* (spathulate) in reference to the shape of the combined lateral sepals.
NOTES. Seidenfaden (1973b) reviewed the taxonomic history of this species. Garay, Hamer & Siegerist (1994) included it in their new genus *Rhytionanthos*, a treatment followed by Seidenfaden (1995).

56. B. sterile (Lamarck) Suresh in Nicolson *et al.*, Rheede, Hort. Malab. 298 (1988). Holotype: based on Rheede's 'theka-maravara' in Hort. Malab. 12: 43, t.22 (1693)!
Epidendrum sterile Lamarck, Encycl. 1: 189 (1783).
Bulbophyllum caudatum Lindl. in Wall. Cat.: 1983 (1829), nom. nud.; Gen. Sp. Orchid. Pl.: 56 (1830). Type: Nepal, Sanko, coll. *Wallich* Wall. Cat. 1983 (holo. K-LINDL!, iso. AMES! K-W! W!).
B. neilgherrense Wight, Icon. Pl. Ind. 5(1): 6, t.1650 (1851). Type: India, Nilgiri Hills, local collector (holo. K).
Cirrhopetalum caudatum sensu (Lindl.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 93, t.129 (1898), non Wight (1851).

Plant epiphytic, growing in large masses; *rhizome* sheathless, 0.8–1mm thick; *roots* clustered from pseudobulb base. *Pseudobulbs* ovoid, compressed, grooved, subquadrate, 0.6–1.3 × 0.4–0.8cm, inserted at intervals of 2.8–7cm along rhizome. *Leaf* 1, ovate-elliptic to ovate-lanceolate, acute, coriaceous, 1.5–3.2 × 0.7–1.4cm; petiole 3–4mm long. *Inflorescence* basal from pseudobulb, umbellately capitate, few-flowered; peduncle sheathed at base, 0.9–1.1cm long; sheaths lanceolate, acute, 5–6mm long; floral bracts lanceolate, 3.5–4.5 × 1.2–2.5mm. *Flowers* 1.5–2cm long; sepals, petals white (semi-transparent when fresh), lip creamy-white, column white; pedicel and ovary glabrous, 1.5–3.5mm long. *Dorsal sepal* oblong-ovate, acuminate, hooded over column, 3.5–4.5 × 1–1.5mm; *lateral sepals* filiform, caudate-acuminate, non-connivent, 1.5–2.3 × 0.15–0.18cm (at base). *Petals* oblong-ovate, obtuse, 2–3 × 0.5–0.8mm. *Lip* 3-lobed, oblong, stipitate, decurved centrally, 2–3 × 0.5–0.6mm; lateral lobes rounded, erect, recurved; mid-lobe entire. *Column* 1–1.5mm long; stelidia 4, upper 2 slender, acute, lower 2 broad, incurved; anther cap papillose.

Sikkim (Chunthang, near Gangtok). On tree trunks in tropical valleys; 500–2000m. Fl. June–July.

GENERAL DISTRIBUTION. Nepal and India.
ETYMOLOGY. From the Latin *sterilis* (infertile) because the Rheede figure shows a non-flowering plant.
NOTE. *B. sterile* is related to *B. vaginatum* (Lindl.) Rchb. f. but has no hairs on the sepals or petals.

57. B. umbellatum Lindl., Gen. Sp. Orchid. Pl.: 56 (1830). Types: Nepal, Sanko, coll. *Wallich* Wall. Cat. 1984 (syn. K-W!, isosyn. BM!); unlocalised, icon. Wallich 1124 (syn. K!).
Cirrhopetalum maculosum Lindl. in Bot. Reg. 27: misc.81, no.173 (1841). Type: India, *Wallich* 158, cult. Loddiges (holo. probably K-LINDL!).
C. bootanense Griff., Not. Pl. Asiat. 3: 296 (1851); Icon. Pl. Asiat. 3: t.299 (1851). Type: Bhutan, *Griffith* s.n. (holo. K-LINDL!, iso. W!).
Bulbophyllopsis maculosa (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 243 (1861).

Bulbophyllum bootanense (Griff.) Parish & Rchb. f. in Trans. Linn. Soc. London 30: 153 (1874).
Bulbophyllopsis maculosum var. *fuscescens* Hook. f., Fl. Brit. India 5(2): 776 (1890). Type: Nepal and Sikkim, probably based on icon. copied from Herb. Calcutta (holo. K!).
Bulbophyllum tibeticum Rolfe in Notes Roy. Bot. Gard. Edinburgh 26: 21, t.9 (1913). Type: China, Xizang (Tibet), *Forrest* 232 (holo. E!).
B. umbellatum var. *fuscescens* (Hook. f.) Sarkar in J. Econ. Taxon. Bot. 5(5): 1007 (1984).
Rhytionanthos bootanense (Parish & Rchb. f.) Garay, Hamer & Siegerist in Nordic J. Bot. 14(6): 639 (1994).

Plant epiphytic, 7–18cm tall; *rhizome* fibrous-sheathed, 2–3mm thick; *roots* slender, branching, from pseudobulb base. *Pseudobulbs* ovoid to broadly conical, rugose, fibrous-sheathed at base, 2.5–3 × 1–1.5cm, inserted at intervals of 1–3cm along rhizome. *Leaf* 1, coriaceous, narrowly oblong, obtuse, emarginate, 4–13 × 1–2cm; petiole 0.6–2cm long. *Inflorescence* shorter than leaves, umbellate to subracemose, 2- to 4-flowered; peduncle sheathed, slender, 7–9cm long; sheaths 2, tubular, lanceolate, mouth wide, 1–1.5cm long; floral bracts lanceolate, acute, 6–7 × 1.5–2mm. *Flowers* 1–1.5cm long; sepals and petals variable, yellow-green, pale pink to yellow-brown, unspotted or finely spotted with pink-purple, lip green-yellow, green or green with puple, column foot green-white unspotted or spotted with purple; pedicel and ovary slender, 1.5–1.6cm long. *Dorsal sepal* broadly ovate, acute, ± depressed, 5-veined, 0.8–1 × 0.5–0.7cm; *lateral sepals* free, ovate-lanceolate, falcate, subacute, base broad, adnate to column foot, 7-veined, 1.3–1.5 × 0.4–0.5cm. *Petals* broadly ovate, obtuse, 5-veined, 6 × 4mm. *Lip* simple, oblong, tapering to subacute apex, surface grooved, 2.5–3.5 × 1.2–1.7mm. *Column* winged, 2–2.5mm tall; stelidia short, curved; foot narrowed, curved, 3–5mm long.

Bhutan: C – Punakha (Chusom, Tinlegang) and Tashigang (near Tashi Yangtsi) districts; **Sikkim** (Chunthang). On mossy cliff face in evergreen forest; 1000–2000m. Fl. March–May.

GENERAL DISTRIBUTION. NE India, Myanmar, Thailand and Vietnam.
ETYMOLOGY. From the Latin *umbella* (parasol-like) in reference to the inflorescence.
NOTES. The floral colouring of this species is highly variable. The sepals and petals of *B. umbellatum* are pale yellow-green and unspotted; *B. maculosum* has pinkish white-green sepals and petals that are spotted with pink and *B. maculosum* var. *fuscescens* has yellow-brown sepals and petals. The floral structure of these plants is identical so we recognise a single, variable species with no varieties. A fuller synonymy is given in Seidenfaden (1973b).

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

B. acutiflorum A. Richard in Ann. Sci. Nat. (Paris) sér.2, 15: 18, t.7 (1841). Type: India, Ootacamund, Nilgiri Hills, *Perrottet* s.n. (holo. G, iso. W!).
Cirrhopetalum acutiflorum (A. Richard) Hook. f., Fl.Brit. India. 5(2): 779 (1890).

NOTE. Reported from the W Kameng district of Arunachal Pradesh by Chowdhery (1998).

B. brienianum (Rolfe) J.J. Smith in Feddes Repert. Spec. Nov. Regni Veg. 32: 306 (1933). Type: Borneo, *sine loc., sine coll.* (holo. K!).
Cirrhopetalum brienanum Rolfe in Bull. Misc. Inform. Kew 1893: 62 (1893).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

B. capillipes Parish & Rchb. f. in Trans. Linn. Soc. London 30: 150, t.32a (1874). Type: Myanmar (Burma), Moulmein, *Parish* s.n. (holo. W! Herb. no. 26103, iso. K!).
Phyllorchis capillipes (Parish & Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 676 (1891).
Drymoda latisepala Seidenfaden in Nordic J. Bot. 1(2): 212, f.16 (1981). Type: Myanmar (Burma), Moulmein, *Parish* s.n. (holo. W! Herb. no. 26103).

NOTE. Seidenfaden (1994a, 1995a) discussed the confusion between this species and B. *monanthum*. We have seen no material of this species (which belongs to section *Micromonanthe*) from our area.

B. cupreum Lindl. in Bot. Reg. 24: misc.95, no.183 (1838). Type: the Philippines, *Cuming* s.n. (holo. K-LINDL!).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

B. delitescens Hance in J. Bot. 14: 44 (1876). Type: Hong Kong, Mt. Victoria, *Ford* 19111, cult. *Lamont* (holo. BM).
Cirrhopetalum delitescens (Hance) Rolfe in Gard.Chron. s.n., 18: 461 (1882).
C. mirificum Gagnepain in Bull. Soc. Bot. France 78: 5 (1931). Type from Vietnam.

NOTES. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh, with B. *mannii* Rchb. f. included as a synonym. This species is related to B. *macraei* (Lindl.) Rchb. f. and to B. *reichenbachianum* Kränzlin. Garay, Hamer & Siegerist (1994) treated B. *reichenbachianum* as a distinct species and B. *mannii* as conspecific. There is therefore some doubt as to the identity of the Kameng plant.

B. depressum King & Pantling in J. Asiat. Soc. Bengal 66(3): 585 (1897). Type: India, Khasia Hills, Jaintia Hills, *Pantling* 627 (holo. CAL!).
Bulbophyllum acutum J.J. Smith, Orch. Java, 6: 466, t.357 (1905). Type from Java.
B. *hastatum* T. Tang & F.T. Wang in Acta Phytotax. Sin. 12(1): 44 (1974). Type: China, Hainan, Tsat Cha Village, *S.K. Lau* 1871 (holo. PE).

NOTES. Das & Deori (1983) reported this species (which belongs to section *Micromonanthe*) from Sikkim and Arunachal Pradesh. Hegde & Rao (1987) also reported it from Munna Camp in the W Kameng district of Arunachal Pradesh. We have seen no material from our area; it has not otherwise been reported from Sikkim and it was not recorded for Arunachal Pradesh by Chowdhery (1998). When describing it, King & Pantling stated that it was closely allied to B. *listeri* (now treated as a synonym of B. *tortuosum* (Bl.) Lindl.) but differed in having a 3-lobed, oblong lip and a column without stelidia.

B. macraei (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 263 (1861). Type: Sri Lanka, *Macrae* s.n. (holo. K-LINDL!).
Cirrhopetalum macraei Lindl., Gen. Sp. Orchid. Pl.: 59 (1830).

NOTES. Reported by Hegde & Rao (1987) from Tipi in the W Kameng district of Arunachal Pradesh. It had previously been reported from Sri Lanka, Taiwan and the Ryukyu Islands by Garay & Sweet (1974) where a full synonymy can be found.

B. nodosum (Rolfe) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 7: 26 (1912). Type: S India, Nilgiri Hills, cult. J. O'Brien s.n. (holo. K!).
Cirrhopetalum nodosum Rolfe in Bull. Misc. Inform. Kew 1895: 35 (1895).

NOTES. Reported by Rao & Haridsan (1997) from the W Kameng district of Arunachal Pradesh. It is closely related to B. *helenae* but differs in having swollen rhizome nodes, a mealy-papillose ovary and an apiculate dorsal sepal.

B. obrienianum Rolfe in Gard. Chron. ser.3, 12: 332 (1892). Type: Himalayas (unlocalised), cult. O'Brien s.n. (holo. K!).

NOTE. Reported by Hegde & Rao (1982a, 1983b) from Sessa and Tipi in the W Kameng district of Arunachal Pradesh.

B. ornatissimum (Rchb. f.) J.J. Smith in Bull. Jard. Bot. Buitenzorg sér.2, 8: 26 (1912). Type: India, Assam, *Bull* 407 (holo. W!, iso. K!).
Cirrhopetalum ornatissimum Rchb. f. in Gard. Chron. n.s.18: 424 (1882).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh. We have seen no material from our area and consider that this report may be based on a misidentification of *B. appendiculatum*.

B. protractum Hook. f., Fl. Brit. India 5(2): 758 (1890); Icon. Pl. 21: t.2037 (1892). Type: Myanmar (Burma), Tenasserim or Andaman Islands, *Helfer* 244 (holo. K!, iso. P).
Phyllorchis protracta (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891).

NOTE. Reported by King & Pantling (1898) from Sikkim but we refer the Pantling specimen to *B. cauliflorum* var. *sikkimense*.

B. pulchrum (N.E. Brown) J.J. Smith in Bull. Jard. Bot. Buitenzorg 2(8): 27 (1912). Type: Halmaheira, *Linden's collectors* (holo. ?).
Cirrhopetalum pulchrum N.E. Brown, Ill. Hort. 33: 139, t.608 (1886).

NOTE. Reported by Hegde & Rao (1987) from Dirrang in the W Kameng district of Arunachal Pradesh.

B. putidum (Teijsmann & Binnendijk) J.J. Smith in Bull. Jard. Bot. Buitenzorg 2(8): 27 (1912).
Type: Sumatra, Palembang, *Teijsmann* s.n. (holo. BO).
Cirrhopetalum putidum Teijsmann & Biennendijk in Natuurk. Tijdschr. Ned.-Indië. 23: 311 (1862).
Mastigion putidum (Teijsmann & Binnendijk) Garay, Hamer & Siegerist in Nordic J. Bot. 14(6): 637 (1994).

NOTE. Reported by Seidenfaden (1973b) from Sikkim, but this was later corrected (Seidenfaden, 1995).

B. repens Griff., Not. Pl. Asiat. 3: 193 (1851); Icon. Pl. Asiat.: t.294 (1851). Type: India, Khasia, Myrung, *Griffith* 1021 (holo. K-LINDL!).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

B. xylophyllum Parish & Rchb. f. in Trans. Linn. Soc. London 30: 151 (1874). Type: Myanmar (Burma), Moulmein, *Parish* 82B (holo. K!).
Phyllorchis xylophylla (Parish & Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 678 (1891).

NOTE. See discussion under *B. gracilipes* above.

100. **Ione** Lindl.

Plants epiphytic or lithophytic, small to medium-sized; *rhizome* stout, creeping. *Pseudobulbs* inserted distantly along rhizome, obovoid. *Leaf* single, coriaceous, erect to suberect, oblanceolate to oblong-elliptic, obtuse. *Inflorescence* basal from pseudobulb, erect, racemose, laxly to densely 1-to many-flowered; *floral bracts* prominent. *Flowers* distichous, small to medium in size. *Sepals* subsimilar; *dorsal sepal* free; *lateral sepals* free or variously connate. *Petals* much smaller than the sepals, margins entire to lacerate. *Lip* simple, entire, fleshy at apex, ecallose or with an obscure fleshy callus. *Column* fleshy; *foot* variable; *anther cap* immobile, persistent; *pollinia* 4, in 2 pairs; *stipes* 2, linear, each independently anchored at rostellar tips; *viscidium* 1; *rostellum* elongate, horseshoe-shaped with diverging points.

The genus *Ione* was established in 1853 by John Lindley in his *Folia Orchidacea*. Garay, Hamer & Siegerist (1994) and Seidenfaden (1995a) discussed the reasons for maintaining this species as distinct from Sunipia. The genus comprises about 14 species distributed from India, Myanmar and Thailand across to Taiwan.

TYPE. *non designatus.*
ETYMOLOGY. Named after the Greek sea-nymph *Ione*.

Key to species

1. Inflorescence 1- or 2-flowered .... **1. I. andersonii**
+ Inflorescence more than 2-flowered 2

2. Scape stout, exceeding leaves .... **4. I. cirrhata**
+ Scape slender, equalling or shorter than leaves 3

3. Lip pandurate, purple; margins of petals entire .... **2. I. bicolor**
+ Lip not pandurate, yellow; margins of petals erose .... **3. I. candida**

1. **I. andersonii** King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 159, t.217 (1898). Types: W Bengal Duars, Buxa, *Anderson* s.n. (syn. CAL); icon. Pantling 473 (syn. CAL, reproduced in King & Pantling (1898), t.217!).
I. andersonii var. *flavescens* (Rolfe) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 90 (1951).
Sunipia andersonii (King & Pantling) P.F. Hunt in Kew Bull. 26(1): 183 (1971).

Plant epiphytic, 6–12cm tall; *rhizome* sheathed, c.2mm across; sheaths distant, tubular, mouth wide, 7–8mm long; *roots* clustered from pseudobulb base. *Pseudobulbs* ovoid, clustered to slightly distant on rhizome, 0.7–1.5 × 0.2cm. *Leaf* narrowly elliptic-oblong, apex blunt, slightly emarginate, 1.3–5(–11) × 0.6–1cm; petiole channelled, 3–4mm long. *Inflorescence* 1- or 2-flowered; peduncle sheathed at base, 7–8mm long; floral bract lanceolate, shorter than ovary, 6–7 × 1.5mm. *Flower* 8–9mm across; sepals and petals yellowish, lip purple; pedicel and ovary exceeding floral bract, c.1 × 0.2–0.25cm. *Sepals* subsimilar, ovate, subacute, apiculate, strongly recurved, 3-veined, 7–8 × 4–5mm. *Petals* widely spreading, narrowly lanceolate, obtuse, membranous, 1-veined, margins fimbriate at base, base dilated, 7 × 2.5mm. *Lip* 3-lobed, 6–7 × 3–3.2mm; lateral lobes narrow, erect, rounded, margins erose; apex fleshy, narrowly oblong, obtuse; base broadly orbicular, shell-shaped. *Column* 2 × 2mm; anther cap fleshy; stipes linear.

Darjeeling (Buxa (King & Pantling, 1898)). 1600m. Fl. April.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Taiwan, Thailand and Vietnam.
ETYMOLOGY. Named after Thomas Anderson (1832–1870), Superintendent of Calcutta Botanic Garden between 1861 and 1868 and collector of the type specimens.
NOTE. A fuller synonymy can be found in Seidenfaden (1986), under *Sunipia andersonii*.

2. **I. bicolor** (Lindl.) Lindl., Fol. Orchid. Ione 2: 3, no.6 (1853). Type: Nepal, icon. Wallich s.n. (holo. K!).
Sunipia bicolor Lindl., Gen. Sp. Orchid. Pl.: 179 (1833).
Dipodium khasianum Griff., Itin. Pl. Khasyah Mts.: 84, no.1219 (1848); Not. Pl. Asiat. 3: 354 (1851); Icon. Pl. Asiat. 2: 327 (1851). Type: India, Khasia Hills, *Griffith* s.n. (holo. K-LINDL!).
Ione khasiana (Griff.) Lindl., Fol. Orchid. Ione 2: 2, no.5 (1853).
Bulbophyllum bicolor (Lindl.) Hook. f., Fl. Brit. India 5(2): 770 (1890).

Plant epiphytic or occasionally lithophytic, 7–12cm tall; *rhizome* branching, c.1mm thick; *roots* filiform, clustered from pseudobulb base. *Pseudobulbs* obpyriform or flask-shaped, narrowed to apex,

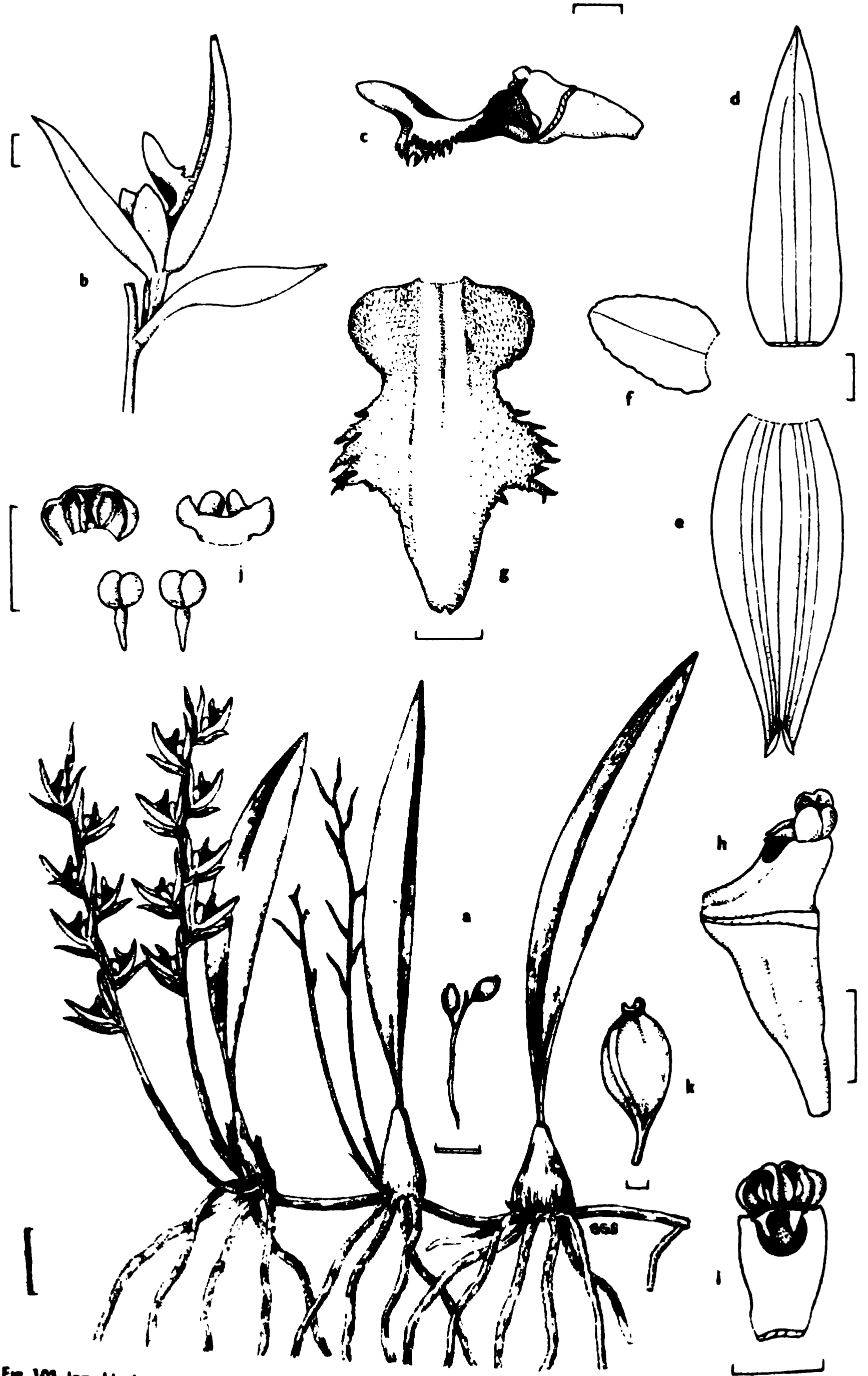

Fig. 103. **Ione bicolor**. a, habit (and detail of infructescence); b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepals; f, petal; g, lip; h, column and ovary; i, column; j, anther (two views) and pollinaria; k, fruit. Drawn by Susanna Stuart-Smith. a–j from *Miehe* 15860 (K); k from *Griffith* 5138 (K).

base broad, 1.2–2 × 0.6–1.8cm, inserted at intervals of 1.5–3.2cm along rhizome. *Leaf* linear-oblong, obliquely emarginate at apex, strongly keeled beneath, 4.8–9.5 × 0.6–1cm; petiole 0.5–1cm long. *Inflorescences* 1 or 2, laxly 6- to 8-flowered; peduncle filiform, glabrous, sheathed at base and above, 2.5–4.5cm long; sheaths tubular, subacute, 0.5–1cm long; rachis glabrous, 2.5–3.5cm long; floral bracts lanceolate, acute, 6–8 × 1.5–2.5mm. *Flowers* 7–9mm long; sepals and petals white-transparent (or flushed purple), veined purple, lip deep purple, column green-yellow; pollinia yellow; pedicel and ovary stout, 2.5–3mm long. *Dorsal sepal* lanceolate, acute, 3-veined, spreading, 7–8 × 1.5–2mm; *lateral sepals* lanceolate, acute, connivent, apices free, diverging, 3-veined, 7–8 × 1.3–2mm. *Petals* ovate to elliptic, acute to subacute, 1-veined, 2.4–2.6 × 1.1–1.3mm. *Lip* pandurate to broadly fusiform, 4–5 × 2–3mm; base truncate, 2-auriculate, expanded centrally, broadly ovate, margins deeply serrate, narrowed to an oblong, obtuse, emarginate apex. *Column* 0.6–0.9mm tall; foot very short. *Fruit* ovoid, ridged, stalked, 4–5 × 2–3mm; stalk 3–4mm long. **Fig. 103; Plate 26.**

Bhutan: S – Chukka (E of Jumadag) and Gaylegphug (N of Chabley Khola) districts; C – Mongar district (Khoma); **Darjeeling** (Dumsong, Lathi, Takdah); **Sikkim** (Rimbi Chhu, Yoksam). On small lichen-covered trees; 1700–2330m. Fl. October–December; Fr. October–December(–February).

GENERAL DISTRIBUTION. NW Himalaya, Nepal, E Himalaya, Myanmar, China and Thailand.
ETYMOLOGY. From the Latin *bicolor* (two-coloured) in reference to the flower.

3. **I. candida** Lindl., Fol. Orchid. Ione 2: 3, no.7 (1853). Type: India, Khasia Hills, *Hooker & Thomson* 70 (holo. K-LINDL!, iso. K!).
Bulbophyllum candidum (Lindl.) Hook. f., Fl. Brit. India 5(2): 770 (1890); Icon. Pl. 21: t.2050 (1890).
Sunipia candida (Lindl.) P.F. Hunt in Kew Bull. 26(1): 183 (1971).

Plant epiphytic, 4–8cm tall; *rhizome* sheathless, 0.8–1cm thick; *roots* long-filiform. *Pseudobulbs* ovoid to obpyriform, 0.9–1.2 × 0.4–0.7cm, inserted at intervals of 1–1.5cm along rhizome. *Leaf* linear to linear-oblong, obtuse, retuse, 4–6.5 × 0.4–0.9cm; petiole channelled, 2–3mm long. *Inflorescences* 1 or 2, laxly 5- to 7-flowered; peduncle slender, glabrous, sheathed, 2.5–3cm long; sheaths 2 or 3, tubular, 5–6mm long; rachis glabrous, 2.5–3.5cm long; floral bracts lanceolate, acute to acuminate, 4–6 × 0.8–1mm. *Flowers* 7–8mm long; sepals and petals white, lip yellow; pedicel and ovary slender, 3–4mm long. *Dorsal sepal* lanceolate, acute, 3-veined, spreading, 5–6 × 1.2–1.5mm; *lateral sepals* lanceolate, acuminate, spreading, 5–6 × 1–1.5mm. *Petals* oblong-ovate, acute, 1-veined, margins erose-dentate, 1.5–2 × 0.8–1mm. *Lip* simple, 5–6 × 1.5–1.9mm (at base); apex elongate, oblong, margins entire; base ovate, margins serrate-erose, incurved. *Column* lacking a foot, 0.5mm long. *Fruit* ovoid, 3–4 × 2–3mm.

Bhutan: C – Tashigang district (near Tashi Yangtsi (M.F.B.)). 2000m. Fl. March.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *candidus* (white) in reference to the flower colour.

4. **I. cirrhata** Lindl., Fol. Orchid. Ione 2: 1, no.1 (1853). Types: India, Sikkim, *Hooker* 51 (syn. K-LINDL!); icon. Cathcart s.n. (syn. K!).
Ione virens Lindl., Fol. Orchid. Ione 2: 1, no.2 (1853). Type: Mishmee Hills, *Griffith* s.n. (holo. K-LINDL!).
I. fuscopurpurea Lindl., op. cit. 2, no.3 (1853). Type: Mishmee Hills, *Griffith* s.n. (holo. K-LINDL!).
I. paleacea Lindl., op. cit. no.4 (1853). Type: India, Darjeeling, *Griffith* s.n. (holo. K-LINDL!).
Bulbophyllum cirrhatum (Lindl.) Hook. f., Fl. Brit. India 5(2): 758 (1890).
B. paleaceum (Lindl.) Hook. f., op. cit. (1890).
B. mishmeense Hook. f., op. cit. 769 (1890). Type: India, Assam, Mishmee Hills, *Griffith* s.n. (holo. K-LINDL!).
B. virens (Lindl.) Hook. f., op. cit. 770 (1890).
Sunipia cirrhata (Lindl.) P.F. Hunt in Kew Bull. 26(1): 184 (1971).

S. *fuscopurpurea* (Lindl.) P.F. Hunt, op. cit. (1971).
S. *paleacea* (Lindl.) P.F. Hunt, op. cit. (1971).
S. *virens* (Lindl.) P.F. Hunt, op. cit. 185 (1971).

Plant epiphytic, to 18cm tall; *rhizome* elongate, creeping, 3–4mm wide; roots slender, inserted along rhizome. *Pseudobulbs* ovoid-conical to obpyriform, rugose, bright green, 2.5–3.5 × 1–1.5cm, inserted at intervals of 3–3.5cm along rhizome. *Leaf* erect, oblong to oblanceolate, obtuse, 9–16 × 2–3.1cm; petiole 1.4–4cm long. *Inflorescence* laxly 4- to 8-flowered; peduncle slender, sheathed at base and above, glabrous, 15–22cm long; sheaths tubular-lanceolate, subacute, 1.2–2.1cm long; rachis slender, glabrous, 5.5cm long; floral bracts lanceolate, acute papery, distichous, suberect, 1.9–2.5cm long. *Flowers* pendent, smelling of honey, 2–2.5cm long; sepals and petals off-white with purple veins, lip rich purple; pedicel and ovary curved, 1–1.6cm long. *Dorsal sepal* lanceolate, acuminate, 7-veined, 1.2–2.4 × 0.3–0.5cm; *lateral sepals* similar, adnate to apex of column foot, connivent to just below the apex, many-veined, 1.4–2.6 × 0.6–0.8cm (across connivent section). *Petals* broadly ovate, obtuse, oblique, margins erose, 3-veined (central vein prominent, lateral ones obscure), 4–5 × 1–1.5mm. *Lip* simple, pendent, lanceolate, acuminate, 1.5–2 × 0.35–0.7cm; disc shortly 2-lamellate, lamellae swollen at base. *Column* stout, 2–3 × 1.1–1.3mm; foot shortly attenuate, 1–3mm long; anther cap with 2 long, forward-pointing projections. *Fruit* pyriform, long-stalked, 1.5–1.9 × 0.6–0.7cm; stalk filiform, 1.5–2cm long.

Bhutan: C – Punakha district (Dawakha); **Darjeeling** (Dumsong, Kurseong); **Sikkim** (Tendong). 1600–2000m. Fl. October–November.

GENERAL DISTRIBUTION. NE India, Myanmar and China (Yunnan).

ETYMOLOGY. From the Latin *cirrhatus* (tendrilled).

NOTE. Seidenfaden (1969, 1986) and Pradhan (1979) have suggested that the four species, *Ione cirrhata*, *I. fuscopupurea*, *I. paleacea* and *I. virens*, proposed by Lindley in 1853 and included in section *Latifoliae*, represent a single variable taxon. Having studied the type material of all four species we agree.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

I. jainii (Hynniewta & Malhotra) Seidenfaden in Opera Bot. 124: 53 (1995). Type: India, Nagaland, Tseningu, *Hynniewta* 56060 (holo. CAL).
Sunipa jainii Hynniewta & Malhotra in J. Indian Bot. Soc. 57: 31 (1978).

NOTE. Hegde & Rao (1987) reported this species from Munna Camp in the Kameng district of Arunachal Pradesh.

101. Monomeria Lindl.

Plant epiphytic; *rhizome* thick. *Pseudobulbs* distant along rhizome. *Leaf* single. *Flowers* resupinate. *Inflorescence* basal from pseudobulb, racemose. *Dorsal sepal* gaping, half as long as the lateral sepals; *lateral sepals* with hispid surface, adnate to distal part of column foot. *Petals* short, obliquely triangular, margins fimbriate. *Lip* 3-lobed; lateral lobes auriculate; disc 2-lamellate. *Column* horned at apex; column foot long; pollinia 4; stipe single, terete, short; viscidium large, globose.

The genus *Monomeria* was established in 1830 by John Lindley in his *Genera and Species of Orchidaceous Plants*. The genus comprises three species distributed from Nepal, NE India, Myanmar and China, to Thailand, Vietnam and ?New Guinea.

TYPE. *Monomeria barbata* Lindl.

ETYMOLOGY. From the Greek *mono-* (one) and *meros* (part) in reference to the apparent absence of petals.

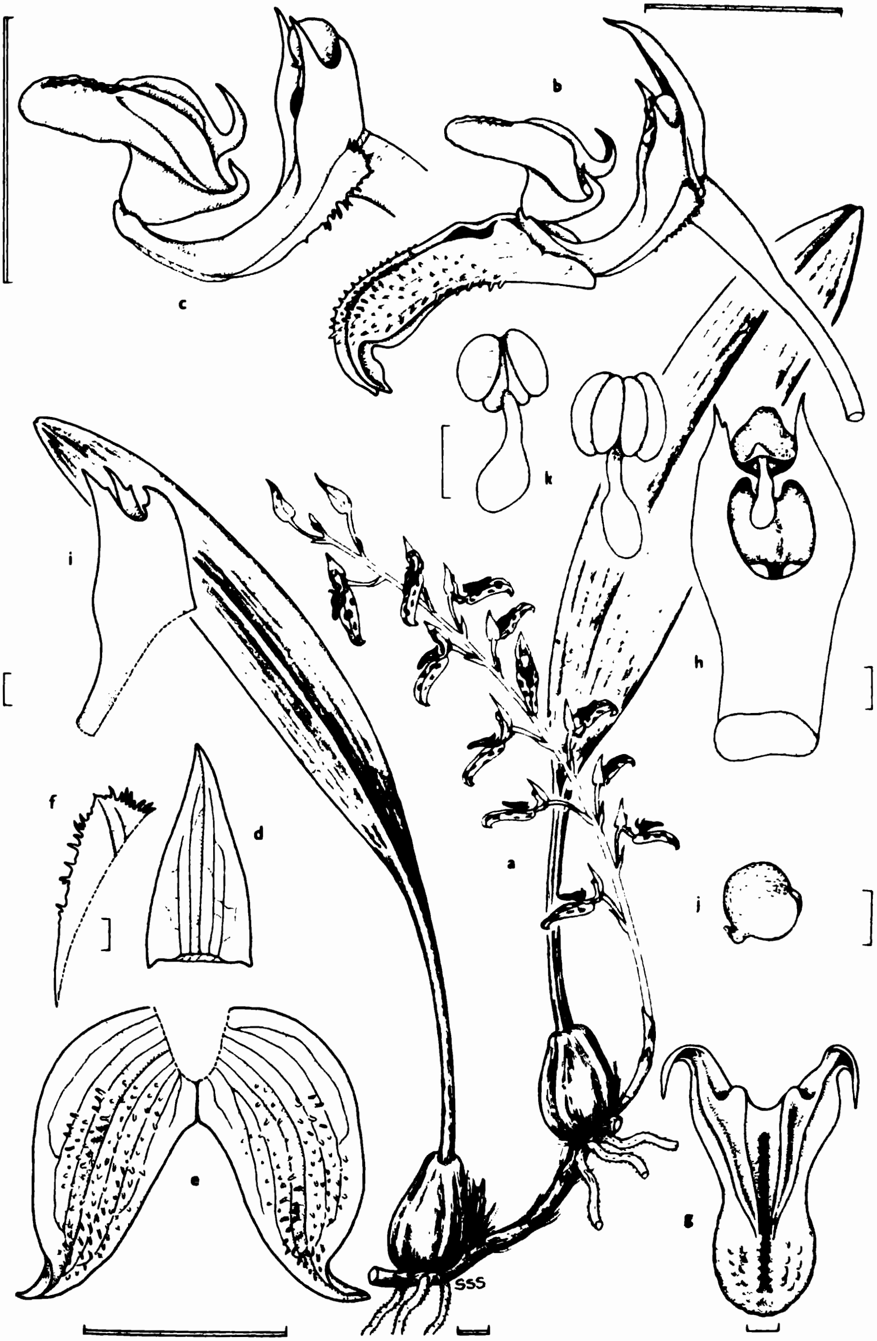

Fig. 104. **Monomeria barbata**: a, habit; b, flower (side view); c, lip, column and ovary; d, dorsal sepal; e, lateral sepals; f, petal; g, lip; h, column apex (front view); i, column apex (side view); j, anther cap; k, pollinarium (two views). Drawn by Susanna Stuart-Smith, a from *Pantling* 124 (K); b–k from *Bailes* 951 (K).

1. M. barbata Lindl., Gen. Sp. Orchid. Pl.: 61 (1830). Type: Nepal, Thoka, coll. *Wallich* Wall. Cat. 1978 (holo. K-LINDL!, iso. BM! K!).
Epicranthes barbata (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 265 (1861).
Monomeria crabo Parish & Rchb. f. in Trans. Linn. Soc. London 30: 143, t.28 (1874). Type: Myanmar (Burma), Taok Mountains, *Parish* 312 (holo. W, iso. K!).

Plant epiphytic; *rhizome* woody, stout; *roots* arising along rhizome. *Pseudobulbs* ovoid-ellipsoid to cylindric, 4–5.5 × 1–2cm, inserted at intervals of 7–9cm along rhizome. *Leaf* oblong-elliptic, apex emarginate, 18.5–23 × 3.5–3.9cm; petiole channelled, 6.5–8.5cm long. *Inflorescence* laxly 7- to 15-flowered; peduncle glabrous, sheathed, 10–12cm long; sheaths overlapping at base, distant above, lanceolate-tubular, 0.7–1cm long; rachis glabrous, 10–25cm long; floral bracts lanceolate, acute, 6–8 × 1.5–2.5mm. *Flowers* 1–1.5cm across; sepals and petals pale yellow with brown to purple markings, lip yellow, column purple-spotted; pedicel and ovary slender, 1.2–2.5cm long. *Dorsal sepal* lanceolate, acute, 1–1.1 × 0.4–0.5cm; *lateral sepals* broadly lanceolate, acute, adnate to apex of column foot and connivent at base to form a small sac, surface densely hispid, 1.4–1.9 × 0.5–0.6cm. *Petals* obliquely triangular, outer margins dentate-fimbriate, adnate to base of column foot, 1.5 × 2.5mm. *Lip* 3-lobed, deflexed centrally, 7–8 × 2.5–3mm; lateral lobes slender, falcate-auriculate, projecting forwards; mid-lobe lanceolate, obtuse; disc 2-lamellate, lamellae coverging. *Column* 2-winged at apex, 1.5–2mm tall; foot curved, 6–9mm long. **Fig. 104.**

Sikkim (unlocalised *Pantling* specimens). Fl. February.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China and Thailand.
ETYMOLOGY. From the Latin *barbatus* (bearded) in reference to the surface of the lateral sepals.

102. Sunipia Lindl.

Plants small to medium-sized, epiphytic; *rhizome* stout, creeping. *Pseudobulbs* distant along rhizome, obovoid. *Leaf* single, coriaceous, erect to suberect, oblanceolate to oblong-elliptic, obtuse. *Inflorescence* basal, erect, racemose, laxly to densely 1- to many-flowered; floral bracts prominent. *Flowers* distichous, small to medium-sized. *Sepals* subsimilar; dorsal sepal free; lateral sepals free or variously connate. *Petals* much smaller than sepals, margins entire to lacerate. *Lip* simple, entire, fleshy at apex, ecallose or with an obscure fleshy callus. *Column* fleshy; foot variable; anther cap immobile, persistent; pollinia 4, in 2 pairs; stipes Y-shaped, paired; viscidium 1; rostellum short, subquadrate.

The genus *Sunipia* was established in 1833 by John Lindley in his *Genera and Species of Orchidaceous Plants*. The confused history of this genus and the related *Ione* was discussed by Seidenfaden (1986, 1995a). The genus comprises about three species distributed from Nepal eastwards through N and NE Thailand and China to Vietnam.

TYPE. *Sunipia scariosa* Lindl.
ETYMOLOGY. Based on a Nepalese vernacular name.

Key to species

1. Inflorescence 1- or 2-flowered; scape shorter than leaves .... 1. S. intermedia
+ Inflorescence many-flowered; scape exceeding leaves .... 2. S. scariosa

1. S. intermedia (King & Pantling) P.F. Hunt in Kew Bull. 26(1): 184 (1971). Type: Sikkim, Tendong, *Pantling* 161A (holo. CAL, iso. BM! K!).
Ione intermedia King & Pantling in J. Asiat. Soc. Bengal 65(2): 120 (1896).

Plant 5–7cm tall; *rhizome* sheathless, c.0.5mm thick; *roots* filiform, from pseudobulb base. *Pseudobulbs* ovoid to narrowly ovoid, semi-transparent, 7–8 × 3–4mm, inserted at intervals of

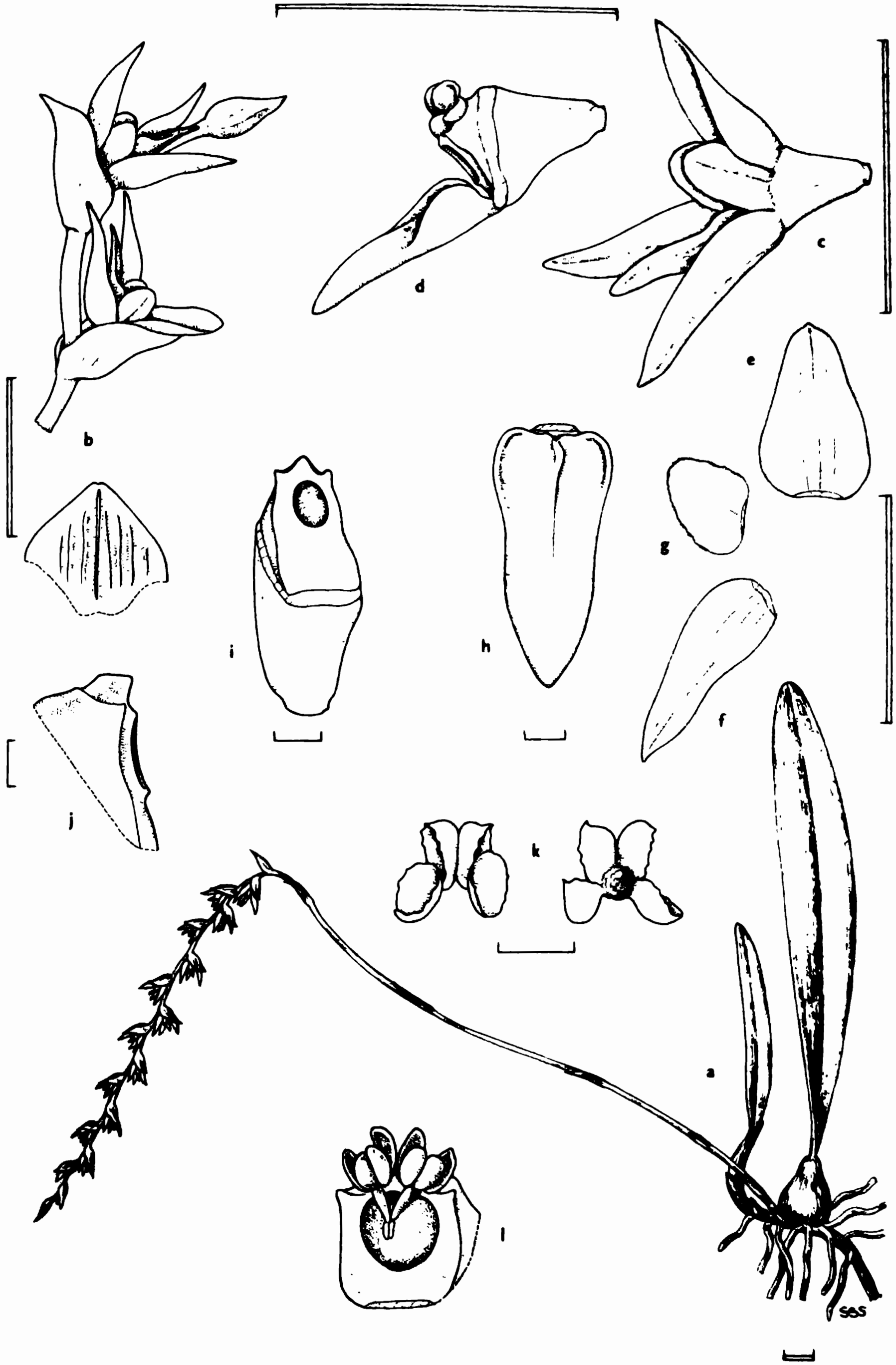

Fig. 105. **Sunipla scariosa**: a, habit; b, inflorescence (with detail of floral bract); c, flower; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column; j, column (side view); k, anther (two views); l, pollinaria (with column apex). Drawn by Susanna Stuart-Smith, a–k from *Sulang* 10014 (K); l from t.219 in King & Pantling (1898).

0.6–1.9cm along rhizome. *Leaf* linear, apex emarginate, 4–6 × 0.2–0.3cm; petiole 3–4mm long. *Inflorescence* 1- or 2-flowered; peduncle glabrous, sheathed at base, 0.7–1cm long; sheaths overlapping, 4–5mm long; floral bracts lanceolate, acute, membranous, 2.5–5 × 1.2–1.5mm. *Flowers* 1–1.1cm across, uniformly pale green; pedicel and ovary expanded upwards, slender, glabrous, c.2.5mm long. *Dorsal sepal* lanceolate, acute, spreading, c.6 × 0.5mm; *lateral sepals* lanceolate, acute, connivent at tips only, c.6 × 1mm. *Petals* linear, twisted, base dilated, concave, margins denticulate, c.3 × 0.8mm. *Lip* simple, lanceolate, 2.5–3mm long; apex caudate-acuminate, margins entire; base dilated, subauriculate, truncately clawed. *Column* narrowly winged, c.1mm tall; stipes 2, attached to a single viscidium.

Sikkim (Chunthang). 2000m. Fl. June.

GENERAL DISTRIBUTION. NE India and China (Xizang).
ETYMOLOGY. From the Latin *intermedius* (between extremes) perhaps a reference to its relationship with *Bulbophyllum* though the precise meaning is unclear.

2. S. scariosa Lindl., Gen. Sp. Orchid. Pl.: 179 (1833). Type: Nepal, Thoka, coll. *Wallich* Wall. Cat. 7373 (holo. K-LINDL!, iso. BM! K! K-W!).
Ione scariosa (Lindl.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 161, t.219 (1898).
I. siamensis Rolfe in Bull. Misc. Inform. Kew 1908: 413 (1908). Type from Thailand.
I. scariosa var. *magnibracteata* Kerr in J. Siam Soc., Nat. Hist. Suppl. 9(2): 237 (1933). Type from Laos.
Sunipia racemosa sensu T. Tang & F.T. Wang in Acta. Phytotax. Sin. 1(1): 90 (1951) *excl. syn. Stelis racemosa*
Ione racemosa sensu Seidenfaden in Bot. Tidsskr. 64: 227 (1969), *excl. syn. Stelis racemosa*.

Plant 16–34cm tall; *rhizome* variably sheathed, 2–3mm thick; *roots* clustered at pseudobulb base. *Pseudobulbs* ovoid to obliquely ovoid, 2–3 × 0.7–2cm, inserted at intervals of 2–2.5cm along rhizome. *Leaf* oblong to linear-oblong, obtuse, emarginate to obliquely emarginate, narrowed at base, strongly keeled beneath, 10–14 × 1.6–2.3cm; petiole channelled, 1.5–2cm long. *Inflorescence* exceeding leaves, laxly 12- to many-flowered; peduncle slender, sheathed, glabrous, red-brown, 7–26cm long; sheaths distant, tubular, 1–1.4cm long; rachis deflexed, weakly zigzag, glabrous, 5–12cm long; floral bracts prominent, scarious (at flowering), ovate, boat-shaped, acute, striate, partly concealing the flowers, pinkish, 5–7 × 2–2.2mm. *Flowers* 6–8mm long, uniformly greenish, flushed purple; pedicel and ovary 1.5–2mm long. *Dorsal sepal* ovate, obtuse, concave, 3.5–5 × 2–2.5mm; *lateral sepals* parallel to one another, oblong-lanceolate, acute, incurved, 5–8 × 1.4–1.5mm. *Petals* broadly ovate, obtuse, 1-veined, subretuse, margins erose-denticulate, base truncate, 2.4–2.5 × 1.8–2mm. *Lip* simple, fleshy, sessile, ovate-elliptic, obtuse, concave, 4 × 1.5mm; disc with a short, oblong callus under the column. *Column* lacking a foot, 0.8–1mm tall; stipes 2, attached to a single viscidium. *Fruit* ovoid, 4–5 × 2–3mm. **Fig. 105.**

Darjeeling (Rilli); **Sikkim** (Tista Valley). 1000–1660m. Fl. April–July.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China, Thailand and Vietnam.
ETYMOLOGY. From the Latin *scariosus* (of thin, dry, membranous texture) in reference to the floral bracts.
NOTE. Garay, Hamer & Siegerist (1994) and Seidenfaden (1995a) have discussed and reviewed the confused taxonomy of this species.

Subfamily **VANDOIDEAE** Endlicher

Tribe **Vandeae** Lindl.

Subtribe **Aeridinae** Pfitzer

103. **Acampe** Lindl.

Plants epiphytic or lithophytic, monopodial. *Stem* simple or branched, stout, leafy. *Leaves* distichous, conduplicate, coriaceous, apex emarginate or 2-lobed. *Inflorescence* axillary, stout, racemose, corymbose, or paniculate; floral bracts inconspicuous, scale-like, persistent. *Flowers* non-resupinate, small, fleshy, fragile. *Sepals* and *petals* similar, flat to curved; lateral sepals adnate to the spur (when present). *Lip* saccate or with a short spur, adnate to the column, immobile, rigid, variously lobed, fleshy, papillose, tuberculate or warty, sometimes dentate; spur lacking any internal tongue or median septum. *Column* short, fleshy, glabrous or papillose; stelidia 2, tooth-like; foot absent; anther ovate, apiculate; pollinia 4, globose, united in 2 pairs; caudicle thick, linear; viscidium small, oval; stigma transverse, concave; rostellum short, emarginate.

The genus *Acampe* was proposed in 1853 by John Lindley in his *Folia Orchidacea*. Although Garay (1972) pointed out that Lindley's earlier name *Sarcanthus* (Lindl. 1824, non 1826, typified by *Epidendrum praemorsum* Roxb.) had priority, the name *Acampe* has now been conserved. The complex and confusing history of this genus has been reviewed by Seidenfaden (1977c). The genus comprises about 10 (possibly fewer) species distributed in SE Asia, tropical and subtropical Africa, Madagascar and the islands of the western Indian Ocean.

TYPE. *non designatus.*
ETYMOLOGY. From the Greek *acamptos* (stiff) in reference to the brittle flowers.

Key to species

1. Leaves more than 4cm broad; epichile surface of lip rugose, margins not wavy .... **3. A. rigida**
+ Leaves less than 2.5cm broad; epichile surface of lip coarsely warty, margins wavy 2

2. Inflorescence paniculate, equalling or exceeding the leaves; lateral lobes of lip protruding; column with 2 short, distinct horns .... **1. A. ochracea**
+ Inflorescence subumbellate, shorter than the leaves; lateral lobes of lip not protruding; column lacking distinct horns .... **2. A. papillosa**

1. A. ochracea (Lindl.) Hochreutiner in Bull. New York Bot. Gard. 6: 270 (1910). Type: Sri Lanka (Ceylon), *Horton*, cult. Loddiges s.n. (holo. K-LINDL!).
Saccolabium ochraceum Lindl. in Bot. Reg. 28: misc.2, no.4 (1842).
Acampe dentata Lindl., Fol. Orchid. Acampe 4: 3, no.8 (1853). Type: India, Sikkim, *Hooker* 179 (holo. K-LINDL!).
Saccolabium lineolatum Thwaites, Enum. Pl. Zeyl.: 304 (1864).
Acampe griffithii Rchb. f.. in Flora 55: 277 (1872). Type: Bhutan, *Griffith* s.n. (holo. W! Herb. no.48508).
A. longifolia sensu Parish in Mason, Burmah 2: 198 (1883), *non* Lindl.
Cleisostoma maculosum sensu Bentham, Gen. Pl. 3: 581 (1883), *non* Lindl.

Plant to 1m tall; roots arising from nodes, fleshy, thick, long. *Stem* 7mm thick, covered by sheaths; internodes 1.5–2cm long; sheaths cylindric, overlapping. *Leaves* many, distichous, fleshy, rigid, oblong, obtuse and 2-lobed at apex, jointed, sessile, 8–22 × 1.5–2.5cm. *Inflorescence* paniculate, leaf-opposed, suberect, many-flowered, 17–22cm tall; peduncle slender, branched, glabrous, sheathed at base, 1–1.5mm thick; sheaths 2, tubular, overlapping, 2–3mm tall; rachis glabrous, 3–7.5cm long; floral bracts broadly triangular, subtubular, 1–1.5 × 1–1.5mm. *Flowers* 0.6–1.2cm across; sepals and petals yellow to ochre with irregular brown markings, lip mid-lobe white, brown-spotted, spur yellow, brown-spotted; pedicel and ovary slender, sparsely pubescent, 2–6mm long. *Dorsal sepal* broadly oblanceolate, obtuse, 5.5–6 × 1.5–2mm; *lateral sepals* oblong, weakly falcate, obtuse, 5–5.5 × 1.5–2.3mm. *Petals* spathulate, obtuse, 4–4.5 × 1.5–1.8mm. *Lip* 3-lobed, 3–4 × 1.5–2mm; lateral lobes small, subtriangular, erect, dentate below; mid-lobe deflexed, fleshy, broadly oblong, obtuse, surface warty, margins undulate; *spur* cylindric, hirsute within, 3–4mm long. *Column* thick, dentate, c.2mm tall; anther cap dome-shaped, beaked; pollinia 0.1–0.2mm long; caudicle clavate, 1mm long. *Fruit* fusiform-ovoid, subsessile, 2–2.9 × 0.5–0.8cm.

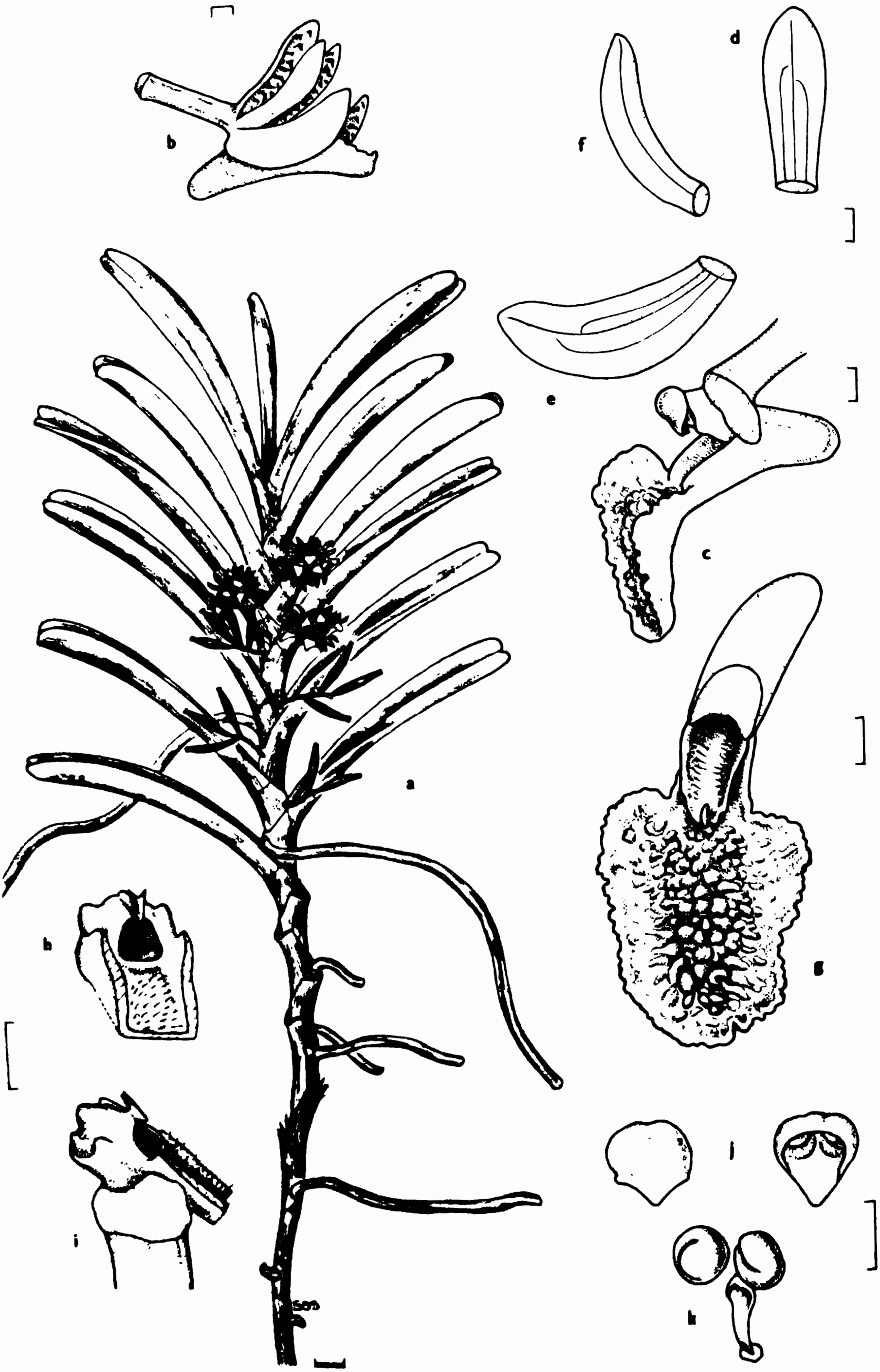

Fig. 106. **Acampe papillosa**: a, habit; b, flower; c, lip and column (side view); d, dorsal sepal; e, lateral sepal; f, petal; g, lip and spur; h, column apex; i, column apex (side view); j, anther cap (two views); k, pollinarium. Drawn by Susanna Stuart-Smith, a from *Pantling* 243 (K); b–k from cult. Kew 175-1924 (K).

Bhutan: – (unlocalised Griffith specimens); **Sikkim** (Tista River Valley). In tropical valleys; 500m. Fl. November–December; Fr. February.

GENERAL DISTRIBUTION. Sri Lanka, NE India, Myanmar, Thailand, Laos, Cambodia and Vietnam.
ETYMOLOGY. From the Latin *ochraceus* (ochre-coloured) in reference to the flower.

2. **A. papillosa** (Lindl.) Lindl., Fol. Orchid. Acampe 4: 2, no.5 (1853). Type: Myanmar (Burma), Prome, coll. *Wallich* Wall. Cat. 7305 (holo. K-LINDL!, iso. K-W!).
Saccolabium papillosum Lindl. in Bot. Reg. 18: t.1552 (1833).
S. carinatum Griff., Not. Pl. Asiat. 3: 354 (1851). Type: India, Serampur, *Griffith* (holo. CAL†).
Gastrochilus papillosum (Lindl.) Kuntze., Revis. Gen. Pl. 2: 661 (1891).
Sarcanthus papillosus (Lindl.) Tixier in Bull. Soc. Roy. Sci. Nat. Laos 9: 30 (1963).
Acampe carinata (Griff.) Panigrahi in Taxon 34(4): 688 (1985).

Plant c.90cm tall; *roots* arising from nodes, long, piercing leaf sheaths. *Stem* elongate, branched, scandent, covered by leaf sheaths, 60–90 × 0.3–0.5cm; sheaths, 2–3cm long. *Leaves* coriaceous, oblong, rounded and obliquely notched at apex, jointed, sessile, 7.5–15 × 1–2.2cm. *Inflorescence* racemose, clustered to subumbellate, densely many-flowered, 3–3.5cm long; peduncle sheathed at base; sheaths circular, overlapping, 2–4cm long; floral bracts semi-circular, triangular, 1–1.5mm long. *Flowers* c.1.8cm across; sepals and petals yellow, blotched with brown, lip whitish; pedicel and ovary 5–6mm long. *Sepals* similar, oblong-elliptic to oblong, obtuse, 0.6–0.9 × 0.2–0.3cm. *Petals* narrowly linear-elliptic, obtuse, 0.6–0.9 × 0.2–0.3cm. *Lip* 3-lobed, weakly saccate at base, 0.4–0.6 × 0.2–0.25cm; lateral lobes obscurely triangular, erect; mid-lobe ovate, margins erose, pubescent-warty in apical half, papillose in basal half; *spur* conical, pubescent within, 2.5–3 × c.1mm. *Column* short, thick. *Fruit* fusiform, 2–2.4 × 0.4–0.6cm. **Fig. 106.**

Bhutan: S – Deothang district (Samdrup Jongkhar (M.F.B.)); **Terai** (Siliguri Plain); **Darjeeling** (Rayeng); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). In tropical valleys; 300m. Fl. October–January; Fr. June–December.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, E Himalaya, Bangladesh, Myanmar, Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *papillosus* (covered with papillae) in reference to the lip surface.
NOTES. Panigrahi (1985) noted that the name *A. papillosa* was illegitimate and proposed the new name *A. carinata* (Griff.) Panigrahi. Seidenfaden (1988) discussed this change and proposed an alternative solution which preserved the older, more well established, name and we follow this here.

3. **A. rigida** (Buchanan-Hamilton ex J.E. Smith) P.F. Hunt in Kew Bull. 24: 98 (1970). Type: Nepal, icon. Buchanan-Hamilton (holo. LINN!, iso. British Library (India Office)!).
Aerides rigida Buchanan-Hamilton ex J.E. Smith in Rees, Cycl.(Addenda) 39: Aerides no.12 (1819).
Acampe intermedia Rchb. f. in Allg. Gartenzeitung 24: 217 (1856). Type: India, Calcutta, *Schiller* s.n. (holo. B).
A. wightiana var. *longepedunculata* Trimen, Syst. Cat. Fl. Pl. Ceylon 90 (1885). Type from Sri Lanka.
Saccolabium longifolium (Lindl.) Hook. f., Fl. Brit. India 6(1): 62 (1890).

Plant erect, 60–90cm long. *Stem* erect, unbranched or branched, 0.8–1cm thick, covered by distichous, overlapping leaf sheaths. *Leaves* distichous, fleshy-coriaceous, conduplicate, curved, linear-oblong, apex unequally 2-lobed, 15–45 × 3.5–5cm. *Inflorescence* axillary, subcapitate, paniculate, densely many-flowered; peduncle sheathed at base; sheaths tubular, overlapping, 0.6–0.8cm long; floral bracts semi-circular, 3–3.5 × 3.5–4.5mm. *Flowers* fleshy, 1.2–1.8cm across; sepals and petals yellow, spotted or marked with crimson or red-brown, lip white spotted with red; pedicel and ovary thick, 1–1.3 × 0.15–0.3cm. *Sepals* ± spreading, subsimilar, free, obovate-elliptic, apex rounded, 0.9–1.4 × 0.5–0.8cm. *Petals* ± spreading, oblong-oblanceolate, falcate, obtuse, 0.9–1.2 × 0.4–0.5cm. *Lip* porrect, obscurely

3-lobed, 0.5–0.8 × 0.3cm; lateral lobes rounded, erect, short; mid-lobe bullate, ovate, rounded; callus a fleshy, pubescent ridge; spur short. *Column* stout, 0.2–0.3cm long. *Fruit* long-cylindric, truncate, 6–7 × 0.7–0.9cm.

Bhutan: C – Punakha (Bhotakha to Punakha) and Tashigang (between Shergaon and Shali (M.F.B.)) districts; **Sikkim** (unlocalised *Pantling* specimen). In tropical valleys; 1200–1250m. Fl. May–June.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, Thailand, Cambodia, Vietnam and Malaysia.

ETYMOLOGY. From the Latin *rigidus* (rigid).

NOTES. Seidenfaden (1977c) discussed the taxonomy of this and the related *A. praemorsa* (see below) and a fuller synonymy can be found there. *A. rigida* was called 'the rigid air-blossom' by J.E. Smith.

Doubtfully recorded and imperfectly known species.

A. praemorsa (Roxb.) Blatter & McCann in J. Bombay Nat. Hist. Soc. 35: 1495 (1932). Lectotype: based on 'thalia-maravora' in Rheede, Hort. Malab. 12: 9, t.4 (1693)!, designated by Seidenfaden in Matthew, Fl. Tamilnadu. Carn. 3(2): 1602 (1983).
Epidendrum praemorsum Roxb., Pl. Coromandel: 34 (1795).
Vanda wightiana Lindl. ex Wight, Icon. Pl. Ind. Orient. 5(1): 9, t.1670 (1851). Type: India, Iyamally Hills, *Wight* (holo. K).
Acampe wightiana (Lindl. ex Wight) Lindl., Fol. Orchid. Acampe 4: 2, no.3 (1853).
Vanda fasciata Gardner ex Lindl., *loc. cit.* (1853), *nom. nud.*
Saccolabium papillosum sensu Dalzell & Gibson, Bombay Fl.: 264 (1861), non Lindl.
S. wightianum (Lindl. ex Wight) Hook. f., Fl. Brit. India 6(1): 62 (1890).
S. praemorsum sensu Hook. f., *loc. cit.* (1890), non (Willdenow) Lindl.

NOTES. Bose & Bhattacharjee (1980) and Dassanayake & Fosberg (1981) reported this species from Sikkim. We have found no material to support these records and suspect they are based upon misidentifications. Dassanayake & Fosberg cited *Pantling* 243 which has subsequently been referred to *A. papillosa*. This species may be conspecific with the later African *A. pachyglossa* Rchb. f., but Cribb (1989) suggested that a detailed study of fresh material of both African and Asian plants was required.

104. Aerides Loureiro

Plants medium-sized, coarse, monopodial, epiphytic. *Stem* short to elongate. *Leaves* linear-oblong to terete, coriaceous, apex 2-lobed. *Inflorescence* variable, racemose or paniculate, pendent, usually densely many-flowered. *Flowers* showy. *Sepals* and *petals* similar, broad, spreading; lateral sepals decurrent on column foot. *Lip* 3-lobed, immobile, spurred; lateral lobes decurrent on the column; mid-lobe often erose; spur forward-curving. *Column* elongate, often broadened at apex; foot short or long; rostellum short or long, bifid; anther 2-celled, ± beaked; stipes long, slender; viscidium semi-circular; pollinia 2, grooved.

The genus *Aerides* was established in 1790 by João de Loureiro in his *Flora Cochinchinensis*. Christenson (1987c) discussed the taxonomy of *Aerides*. The genus comprises 19 species distributed from Sri Lanka, India, Nepal, Bhutan, Myanmar, China, Thailand, Indo-China, and Malaysia to the Philippines and Indonesia. Seidenfaden (1988) revised the Thai species and a fuller synonymy can be found there.

The pollinator of *A. odoratum* is a *Xylocopa* bee (Carr, 1928). The lip of this species is constructed in such a way that a pollinating insect must physically bend it down to gain access to the nectar-filled spur and the column. Only moderately strong bees such as *Xylocopa* are able to force this lip open. The plant also secretes a sticky substance on the stem and outside the sepals and petals that attracts ants but discourages them from entering the lip.

TYPE. *Aerides odoratum* Loureiro.
ETYMOLOGY. From the Greek *aer-* (air) and the Latin suffix *-idus* (resembling), a reference to the epiphytic habit of these plants.

Key to species

1. Lip mid-lobe narrow, turning upwards; spur prominent, horn-like .... **1. A. odoratum**
+ Lip mid-lobe broad, forward pointing; spur short, inconspicuous 2

2. Lip mid-lobe cordate, apex emarginate-truncate; pedicel and ovary less than 1cm long **2. A. multiflorum**
+ Lip mid-lobe triangular, apex acute; pedicel and ovary more than 1cm long ...... **3. A. roseum**

Section **Aerides**

1. **A. odoratum** Loureiro, Fl. Cochinch. 2: 525 (1790). Type: Cochinchina (Vietnam), *Loureiro* s.n. (holo. BM!, iso. (fragm.) K!).
Epidendrum odoratum (Loureiro) Poiret in Lamarck, Encycl. suppl. 1: 385 (1810).
Aerides cornutum Roxb., Hort. Bengal: 63 (1814), *nom. nud.*; Fl. Ind. ed. 1832. 3: 472 (1832). Type: Bangladesh, Dacca, [icon. of] '*Aerides cornutum*' Roxburgh 2093 (holo. CAL, iso. K!).
Orxera cornuta (Roxb.) Rafinesque, Fl. Tellur. 4: 37 (1836). Type: Nepal, *Roxburgh* s.n. (holo. BM!).

Plant up to 1m long. *Stem* stout, pendent, branched, covered by persistent leaf sheaths, 10–30cm long. *Leaves* oblong, round-lobed at apex, incurved, distichous, jointed, pale green, 15–30 × 1.8–5cm. *Inflorescences* numerous, pendent, racemose, densely many-flowered; peduncle stout, glabrous, sheathed; sheaths broadly ovate, obtuse, distant, 5–7mm long; rachis stout, glabrous, to 20cm long; floral bracts lanceolate, acute, 5–9mm long. *Flowers* fragrant, 1.5–2.5cm across, purple to almost white, often tipped and spotted purple, spur greenish-yellow at apex; pedicel and ovary slender, 1–2.5cm long. *Dorsal sepal* oblong, obtuse, 1.1–1.2 × 0.6–0.8cm; *lateral sepals* narrowly triangular-lanceolate, decurrent on the column foot, 1–1.4 × 0.5–1cm. *Petals* narrowly oblong, obtuse, 1.1–1.2 × 0.5–0.7cm. *Lip* 3-lobed, almost enclosing the column, spurred, fleshy, 1–1.2 × 0.4–0.5cm; lateral lobes erect, weakly wedge-shaped to subquadrate, margins entire to dentate; mid-lobe short, incurved, oblong-lanceolate, acute, margins entire to erose; disc with 2 small keels around the nectary and 2 curved appendages in the mouth; *spur* horn-like, incurved, 1.1–2cm long. *Column* 2–3mm long; foot 5–6mm long; anther cap obtuse, beaked, c.3mm long. *Fruit* ovoid, shortly stalked, 2.2–3 × 1–1.4cm.

Bhutan: S – Samchi (Daina Khola) and Sarbhang (Jhogi Dhanra) districts; **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). In low valleys, in secondary subtropical forest slopes; 360–710m. Fl. March–May.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, NE India, Myanmar, Thailand, Laos, Vietnam to Malaysia, Sumatra, Java, Timor, Borneo, Sulawesi and the Philippines.
ETYMOLOGY. From the Latin *odoratus* (scented).

Section **Fieldingia** Pfitzer in Engler, Nat. Pflanzenfam. ed.1, 2(6): 217 (1889); E.A. Christenson, Proc. 14th World Orchid Conf.: 215 (1993), *emend.*

2. **A. multiflorum** Roxb., Pl. Coromandel 3: 67, t.271 (1820). Type: India, Meghalaya, Garrow Hills, near Sylhet, [icon. of] '*Aerides multiflorum*' Roxburgh 2346 (holo. K!).
Aerides affine Lindl., Gen. Sp. Orchid. Pl.: 239 (1833). Types: Bangladesh, Sylhet, coll. *F. De Silva* & *H. Bruce* Wall. Cat. 7316A (syn. K-LINDL!, isosyn. K-W!); Nepal, coll. *Wallich* Wall. Cat. 7316B (syn. K-LINDL!, isosyn. K-W!).

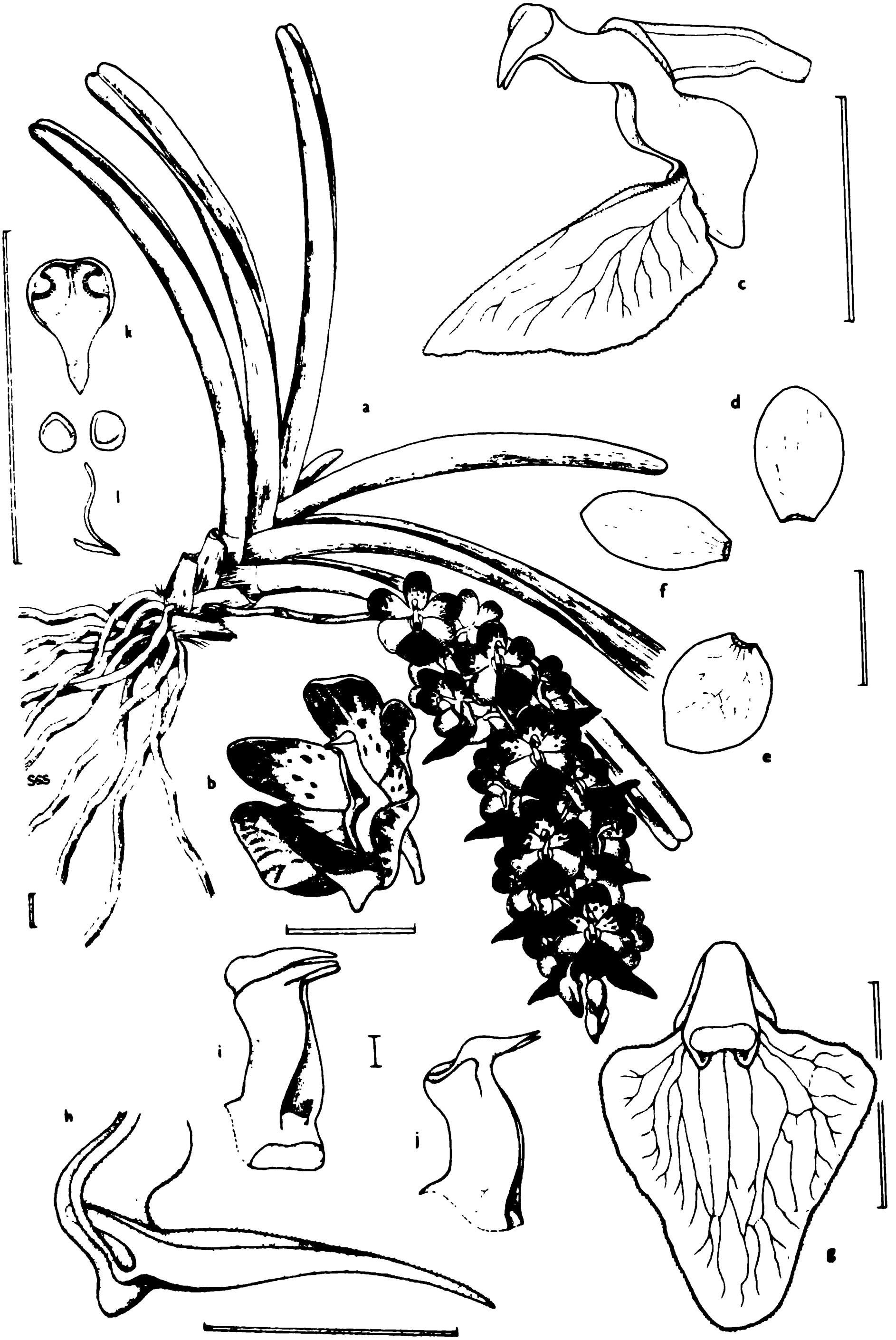

Fig. 107 **Aerides multiflorum**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip, h, lip (section), i, column; j, column (with anther removed); k, anther cap; l, pollinarium. Drawn by Susanna Stuart-Smith, a from *Gamble* 9432 (K), b–l from *Trudel* 714 (K)

Epidendrum geniculatum sensu Buchanan-Hamilton ex Hook. f., Fl. Brit. India 6(1): 45 (1890), non Barbosa Rodrigues.

Plant erect to pendent; *roots* fleshy, fibrous, 4–6mm thick. *Stem* many-leaved, covered by persistent leaf sheaths, 10–25 × 1–1.8cm. *Leaves* oblong, apex broadly 2-lobed, weakly curved, distichous, deeply channelled above, keeled beneath, 12–34 × 1.3–1.9cm. *Inflorescence* racemose or paniculate, from within leaf sheath, densely many-flowered; peduncle sheathed, glabrous, 8–14cm long; sheaths tubular, semi-circular, 5–8mm long; rachis glabrous, 16–30cm long; floral bracts triangular-ovate, 2–4mm long. *Flowers* fragrant, 2–3.2cm across; sepals and petals white to pinkish-purple, apex often spotted with darker amethyst-purple, lip light amethyst-purple, column white; pedicel and ovary 4–5mm long. *Sepals* similar, oblong, elliptic-oblong to orbicular, rounded, 0.6–1.6 × 0.4–1cm; lateral sepals decurrent on the column foot. *Petals* oblong, elliptic-oblong to orbicular, rounded, 0.8–1.6 × 0.6–1cm. *Lip* clawed, geniculate, 3-lobed, convex, margins recurved, 1.3–1.5 × 0.8–1.1cm; lateral lobes erect, semi-circular; mid-lobe cordate to hastate-ovate, rounded, slightly convex above; callus at base of mid-lobe, fleshy, incurved, 2-lobed; *spur* porrect, straight, compressed, 0.4–0.5cm long. *Column* apex beaked, 2–3mm long, beak 2.5–3.5mm long; foot with 2 rounded auricles; stipe glandular-pubescent, c.2.5mm long; viscidium subquadrate; pollinia 0.6–0.8mm across. *Fruit* stalked, ovoid, 1.5 × 0.6–0.9cm. **Fig. 107; Plates 26, 27.**

Bhutan: **S** – Samchi (Daina Khola), Phuntsholing (Phuntsholing) and Sarbhang (near Sarbhang, Mankhola River) districts; **Darjeeling** (unlocalised Griffith specimen); **Darjeeling/Sikkim** (Great Rangit River); **Sikkim** (unlocalised Pantling specimen). In tropical valleys, on river banks on *Dillenia pentagyna* and *Fraxinus* sp., in secondary subtropical forest; 200–660m. Fl. March–June.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, India, Bangladesh, Myanmar, Thailand, Laos, Cambodia and Vietnam.
ETYMOLOGY. From the Latin *multi-* (many) and *-florus* (flowered).

3. **A. roseum** Loddiges ex Lindl. & Paxton in Paxton's Fl Gard. 2: 109, t.60 (1852). Type: India, *Loddiges* 1530 (holo. K-LINDL!).

Aerides trigonum Klotzsch in Allg. Gartenzeitung 23: 177 (1855). Type without provenance, cult.

A. fieldingii B.S. Williams, Orch.-Grow. Man. ed.2: 39 (1862). Type: India, cult. (not located).

A. williamsii Warner, Select Orchid. Pl. 1: t.21 (1862). Type: India, cult. Warner (holo. [icon. in] Select Orchid. Pl. 1: t.21 (1862)!).

A. affine var. *roseum* (Loddiges ex Lindl. & Paxton) Parish in Mason, Burmah 2: 198 (1883).

A. fieldingii var. *williamsii* (Warner) Veitch, Man. Orchid. Pl. 7: 69 (1891).

Plant robust. *Stem* stout, covered with leaf sheaths, 10–25cm long. *Leaves* oblong, 2-lobed, deeply channelled above, keeled beneath, curved, jointed, 15–35 × 2.5–4.3cm. *Inflorescence* arising from peduncle sheath, racemose or paniculate, densely many-flowered; peduncle sheathed, 11–20cm long; sheaths distant, tubular, broadly ovate, 6–9mm long; rachis 25–35cm long; floral bracts triangular, 3–6mm long. *Flowers* 1.5–3.7cm across; dorsal sepal and petals amethyst-purple, suffused with white, lateral sepals white with a pale apical spot, lip amethyst-purple mottled with white, spur whitish; pedicel and ovary 1.1–1.9cm long. *Dorsal sepal* obovate, obtuse, 1.2–1.8 × 0.5–0.6cm; *lateral sepals* broadly elliptic, decurrent on the column foot, 1.2–1.9 × 0.6–0.7cm. *Petals* obovate, obtuse, 1.2–1.8 × 0.6–0.7cm. *Lip* 3-lobed, deltoid to trowel-shaped, acute, slightly laterally compressed, spurred, 1.4–1.6 × 0.8–1.1cm; lateral lobes small, incurved (over mouth of spur); mid-lobe hastate, acute; *spur* funnel-shaped, 4mm long. *Column* 5mm long; anther cap beaked. *Fruit* shortly stalked, ovoid, ridged, 1.5–1.8 × 0.6–0.7cm.

Bhutan: **C** – Punakha district (Maru Chu Valley). Growing on tree trunks; 1500m. Fl. May.

GENERAL DISTRIBUTION. NE India, Myanmar, China (Yunnan), Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *roseus* (rose coloured) in reference to the flower.

Doubtfully recorded and imperfectly known species.

A. falcatum Lindl. in Paxton's Fl. Gard. 2: 142 (1852). Type: E Indies, cult. G. Larpent s.n. (holo. K-LINDL!).
Aerides larpentae Hort. ex Rchb. f. in Allg. Gartenzeitung 24: 219 (1856), nom. alt.
A. mendelii Hort. ex B.S. Williams, Orch.-Grow. Man. ed.4: 67 (1871). Type without provenance.
A. siamense Klinge in Trudy Imp. S.-Peterburgsk. Bot. Sada 17: 134 (1899). Type from Thailand.

NOTE. Reported by Bose & Bhattacharjee (1980) from Sikkim, but we have seen no material from our area and consider that the report is probably based on a misidentification.

105. Arachnis Bl.

Plants epiphytic, robust, monopodial. *Stem* branched, long, often to several metres, scrambling. *Leaves* oblong, rigid, apex 2-lobed. *Inflorescence* rigid, often long and branched, few- to many-flowered. *Flowers* resupinate, often large and showy, fragrant. *Sepals* and *petals* narrowly oblong to linear, spreading. *Lip* short, 3-lobed, jointed to the column foot by a short strap, base saccate or spurred; mid-lobe with a raised, central ridge or callus. *Column* short and stout; *stipes* short, broad; *viscidium* broadly ovate; *pollinia* 4, appearing as 2 unequal masses.

The genus *Arachnis* was established in 1825 by Carl Blume in his *Bijdragen tot der Flora van Nederlandsch Indië* based upon *Arachnis moschifera*, an illegitimate name. The genus comprises about 13 species distributed from Sikkim and mainland Asia to Indonesia, New Guinea and the Pacific Islands.

Tan (1975) reviewed its history and that of the related genera *Armodorum*, *Dimorphorchis* and *Esmeralda*.

TYPE. *Arachnis flosaeris* (L.) Rchb. f.; basionym: *Epidendrum flosaeris* L.
ETYMOLOGY. From the Greek *arachne* (spider), a reference to the resemblance of the flower, with its usually striped sepals, to a spider.

1. **A. labrosa** (Lindl. & Paxton) Rchb. f. in Bot. Centralbl. 28: 343 (1886). Type: Tropical Asia, locality unknown, cult. Egerton (holo. K-LINDL!).
Arrhynchium labrosum Lindl. & Paxton in Paxton's Fl. Gard. 1: 142 (1850).
Renanthera bilinguis Rchb. f. in Bonplandia 2: 93 (1854). Type: China, cult. Booth (holo. W).
R. labrosa (Lindl. & Paxton) Rchb. f., Xenia Orchid. 1: 88 (1855).
Arachnanthe bilinguis (Rchb. f.) Bentham in J. Linn. Soc., Bot. 18: 332 (1881).
Armodorum labrosum (Lindl. & Paxton) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 10: 197 (1911).
Renanthera leptantha Fukuyama ex Hseih in Quart. J. Taiwan Mus. 8: 276 (1955), nom. nud.
Armodorum bilinguis (Rchb. f.) Ho, Cay-co Mien-nam Vietnam ed.2: 1101, t.5271 (1972).

Plant 50–100cm long; roots thick, axillary. *Stem* erect, covered by leaf sheaths; sheaths 2.5–3.5cm long. *Leaves* oblong, apex broadly and unequally 2-lobed, sessile, jointed, distichous, bases overlapping, 16–26 × 2–2.8cm. *Inflorescence* axillary, arising from within leaf sheath, very long, slender, occasionally branched, 3- to 6-flowered; peduncle sheathed, 30–80cm long; sheaths inserted 4–6.5cm apart, ovate-lanceolate, subacute, 1–1.2cm long; rachis short; floral bracts ovate, subacute, 7–9 × 3–4mm. *Flowers* 2–3.5cm across; sepals and petals pale yellow with dark brown-maroon markings, lip cream-yellow, callus yellow, column white; pedicel and ovary slender, 1–2cm long. *Dorsal sepal* oblong, subacute, 1.2–1.5 × 0.2–0.25cm; *lateral sepals* oblong-lanceolate, acute, 1.2–1.8 × 0.2cm. *Petals* oblong-spathulate, acute, 0.9–1.1 × 0.2cm. *Lip* obscurely 3-lobed, shortly clawed, fleshy, spurred, 0.6–1 × 0.2–0.3cm long; lateral lobes short, horn-like to truncate, 0.8–1mm long; mid-lobe oblong-lanceolate, with a fleshy, oblong, 2-layered, obtuse protuberance, subglobose at apex (projecting beyond the

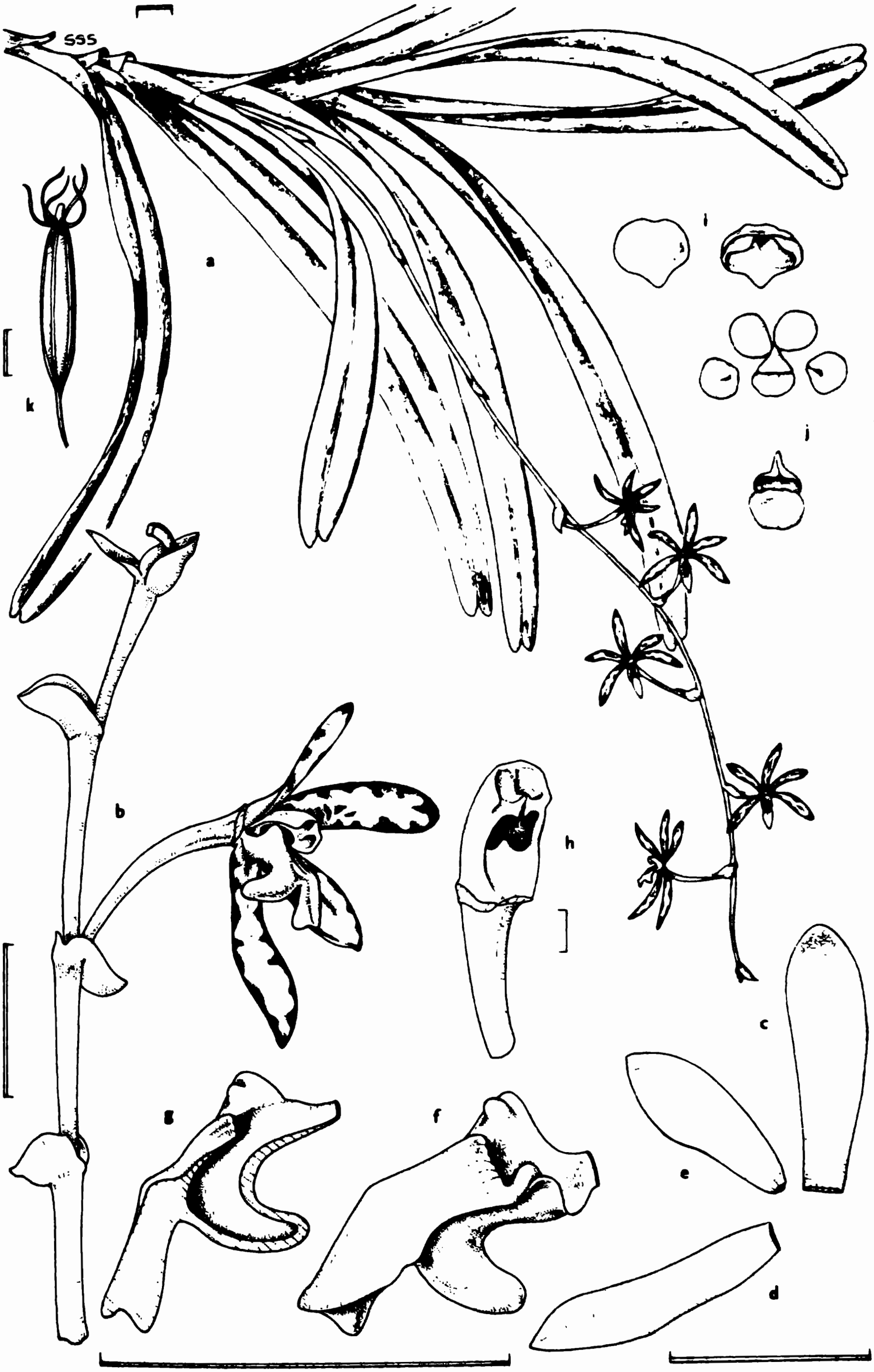

Fig. 108. **Arachnis labrosa**: a, habit; b, inflorescence; c, dorsal sepal; d, lateral sepal; e, petal; f, lip (side view); g, lip (sectioned); h, ovary and column; i, anther cap (two views); j, pollinarium; k, fruit. Drawn by Susanna Stuart-Smith, a from *Tsang* 627 (K); b–h from *Egerton* 1850 (K); i–j from Hort. Kew 1885 (K); k from *Tsang* 27158 (K).

horned spur); callus 6-keeled at base, fleshy; spur horn-like, 2–2.5 × 1–1.2mm. Column slender, straight, 3–4mm long; anther cap 2.2–5mm across; stigma circular to weakly cordate. **Fig. 108.**

Bhutan: (unlocalised record (Würmli, 1973)), (**Sikkim** (Rumpti? Valley). Fl. August.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Vietnam and ?the Ryukyu Islands.
ETYMOLOGY. From the Latin *labrosus* (lipped).
NOTE. Most modern authors treat this species within *Arachnis* rather than in *Armodorum*.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

A. flosaeris (L.) Rchb. f. in Bot. Centralbl. 28: 343 (1886). Lectotype: [icon.] 'angurèk katong'ging' in Kämpfer, Amoen. Exot. Fasc.: 868, t.868 (1712)!, designated by Wood in Taxon 48(1): 47 (1999).
Epidendrum flosaeris L., Sp. Pl.: 952 (1753).

NOTE. Reported from the Kameng district of Arunachal Pradesh by Chowdhery (1998), but Seidenfaden (1988) considered the report highly doubtful. We have seen no material from our area and consider that the record is likely to be due to a misidentification.

106. Ascocentrum Schltr.

Plants small, epiphytic. *Inflorescence* erect to spreading, many-flowered. *Flowers* small, opening widely. *Sepals* and *petals* similar. *Lip* 3-lobed, immobile, adnate to base of the column and slightly joined to it at the base of the lateral lobes, spurred; mid-lobe oblong, porrect or decurved; spur lacking keels or septa but with a small thickening in the mouth at the base of the mid-lobe. *Column* short, lacking a foot; pollinia 2, cleft; stipe short.

The genus *Ascocentrum* was established in 1913 by Rudolf Schlechter in *Feddes Repertorium Specierum Novarum, Beihefte*. The genus comprises five species distributed from the Himalayas to SE Asia, China, Taiwan, Java and the Philippines.

TYPE. *Ascocentrum miniatum* (Lindl.) Schltr.; basionym: *Saccolabium miniatum* Lindl.
ETYMOLOGY. From the Greek *ascos* (a bag) and *centron* (a spur).

Key to species

1. Leaves flat .... **1. A. ampullaceum**
+ Leaves terete .... **2. A. himalaicum**

1. A. ampullaceum (Roxb.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 975 (1913).
Type: India, M.R. Smith s.n. (holo. not found); Lectotype (selected here): [icon. of] '*Aerides ampullaceum*' Roxburgh 2347 (lecto. K!).
Aerides ampullacea Roxb., Fl. Ind. ed. 1832, 3: 476 (1832).
Saccolabium ampullaceum (Roxb.) Lindl., Sert. Orchid. 4: t.17 (1838).
Angraecum campyloplectron Rchb. f. in Bonplandia 3: 226 (1855). Type without provenance.
Gastrochilus ampullaceus (Roxb.) Kuntze, Revis. Gen. Pl. 2: 661 (1891).
Ascocentrum ampullaceum var. *aurantiacum* Pradhan, Indian Orch.: Guide Identif. Cult. 2: 561 (1979).
Type: India, Manipur, M. Singh s.n. (Herb. U.C. Pradhan).

Plant 9–16cm tall; roots basal and arising from nodes, cord-like. *Stem* unbranched, covered by leaf sheaths, 2–4cm long; sheaths 1–1.4cm long. *Leaves* distichous, overlapping, oblong, apex unequally 2-lobed (with a small acute tooth between the lobes) to praemorse, jointed, 5–14 × 0.6–1.1cm. *Inflorescence* erect, subsessile, shorter than the leaves, axillary, 5- to 16-flowered; peduncle sheathed at base, 1–1.5cm long; sheath tubular, 0.7–0.9cm long; rachis glabrous, 1.5–2.5cm long; floral bracts triangular, acute, 0.5–1 × 0.5–1mm. *Flowers* 1.5–1.8cm across, uniformly deep pinkish-red, anther

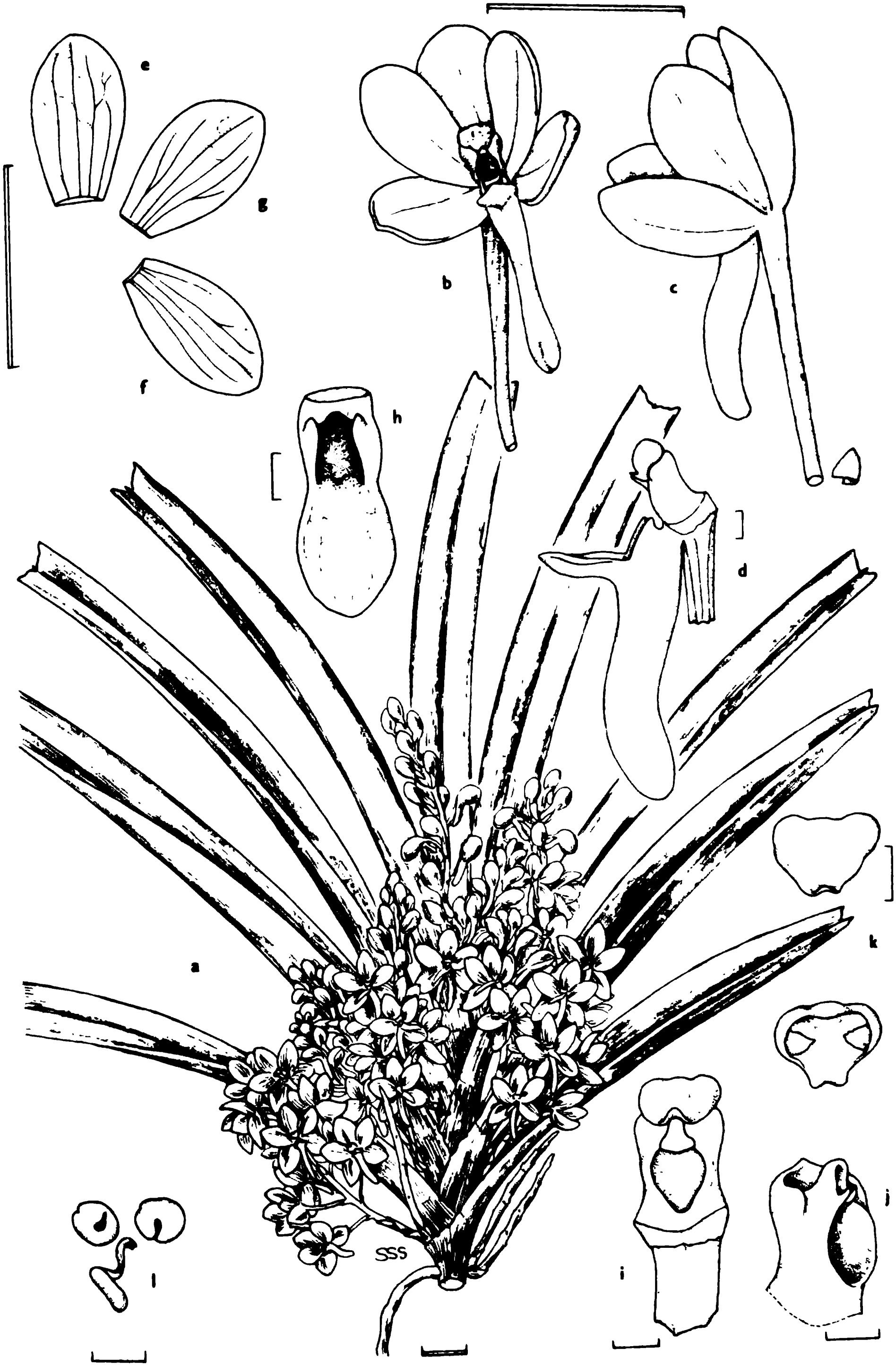

Fig. 109. **Ascocentrum ampullaceum**: a, habit; b, flower (front view); c, flower (side view); d, lip and column; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column; j, column apex (side view); k, anther (two views); l, pollinarium. Drawn by Susanna Stuart-Smith, a from *Pantling* 259 (K); b–l from *Bailes* 972 (K).

purplish; pedicel and ovary slender, 0.7–1.1cm long. *Sepals* similar, elliptic-obovate, obtuse to rounded, 5-veined, spreading, 0.5–0.9 × 0.3–0.5cm. *Petals* elliptic-obovate, rounded, 5-veined, 0.6–1 × 0.3–0.5cm. *Lip* simple, spurred, oblong, deflexed, apex rounded, 0.6–0.7 × 0.2–0.3cm; spur straight to slightly curved, slightly inflated at apex, 0.7–0.9cm long. *Column* 2–3mm long; pollinia 0.25–0.5mm across. *Fruit* ovoid, ridged, stalked, 2.4–2.9 × 0.7–0.8cm; stalk c.1.5cm long. **Fig. 109; Plate 27.**

Bhutan: S – Sarbhang (10km SW of Singi Khola) and Gaylegphug (between Lodrai Khola and Aie Bridge) districts; **Sikkim** (Gangtok, Rungait). In subtropical terai forest on river banks; 330–390m. Fl. March–April(–May).

GENERAL DISTRIBUTION. NW India, Nepal, NE India, the Andaman Islands, Myanmar, China, Thailand and Laos.

ETYMOLOGY. From the Latin *ampullaceus* (flask-shaped) in reference to the spur.

NOTES. Lindley considered his *Saccolabium rubrum* to be indistinguishable from *S. ampullaceum* but Seidenfaden (1988) pointed out that the former species does not have conical calluses on the lateral lobes of the lip and therefore reinstated it as *A. rubrum* (Lindl.) Seidenfaden. This species occurs in Nepal but has not yet been found in our area.

2. **A. himalaicum** (Deb, Sengupta & Malick) E.A. Christenson in Notes Roy. Bot. Gard. Edinburgh 44(2): 256 (1987). Type: Upper Burma (Myanmar), Sima, Shalik Mokin 13 (holo. CAL).

Saccolabium himalaicum Deb, Sengupta & Malick in Bull. Bot. Soc. Bengal 22: 213 (1968).

Holcoglossum junceum Z.H. Tsi in Acta Phytotax. Sin. 20: 442 (1982). Types: China, Yunnan, Shaungjiang, M.K Li 1798 (holo. PE!).

H. himalaicum (Deb, Sengupta & Malick) Averyanov in Bot. Zhurn. (Moscow & Leningrad) 73(3): 432 (1988).

H himalaicum (Deb, Sengupta & Malick) Senghas in Schltr., Orchideen ed.3, 1(19–20): 1194 (1988).

Plant 30–40cm tall; roots arising from nodes. *Stem* slender, 5–10cm long. *Leaves* slender, acute to acuminate, terete, minutely warty, 35–45 × 0.1–0.2cm. *Inflorescence* racemose, supra-axillary, 4–12cm long, laxly 15–22-flowered: peduncle sheathed at base and above, 1.5–2cm long; basal sheath tubular, 3–4mm long, upper sheaths distant, ovate, acute, c.3mm long; rachis stout, 4.5–6cm long; floral bracts ovate, glabrous, c.2mm long. *Flowers* c.1cm long, red or purple; pedicel and ovary 5–7mm long. *Dorsal sepal* oblong-oblanceolate, 3-veined, c.4 × 1.5mm; *lateral sepals* broad, obovate, 3-veined, c.4 × 2mm. *Petals* broader than the sepals, obovate, 3-veined, c.4 × 2mm. *Lip* 3-lobed, spurred at base, ecallose, adnate to the column foot; lateral lobes rounded; mid-lobe broadly obovate, deflexed; spur tapering, curved, 5–6mm long. *Column* stout, c.1 × 1mm; anther cap hemispheric, shortly beaked; pollinia 2, globose. *Fruit* ellipsoid-cylindric, 1.5–1.8 × 3–4cm.

Bhutan: C – Tongsa district (Shemgang). 1330m. Fl. and Fr. November.

GENERAL DISTRIBUTION. NE India, Myanmar and China.

ETYMOLOGY. From the Himalayas, where the type specimen was collected.

NOTE. Christenson (1987b) transferred this species to *Ascocentrum* when he revised *Holcoglossum* Schltr.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

A. curvifolium (Lindl.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 975 (1913). Lectotype: Sri Lanka, Macrae 87 (K-LINDL!), designated by Seidenfaden in Opera Bot. 95: 311 (1988).

Saccolabium curvifolium Lindl., Gen. Sp. Orchid. Pl.: 222 (1833).

NOTES. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh, but we have seen no material from our area and consider that it might be based on a misidentification. Seidenfaden (1988) considered Hooker's report of the species from Assam to be doubtful.

A. semiteretifolium Seidenfaden in Bot. Tidsskr. 65: 358, f.26 (1970). Type: Thailand, Doi Khun Huay Pong, *Seidenfaden* & *Smitinand* 7276 (holo. C).

NOTES. This species is closely related to *A. himalaicum* and, when describing it, Seidenfaden considered it to be endemic to Thailand. Rao (1995b) reported it from Sessa in the W Kameng district of Arunachal Pradesh. We have seen no material from our area and consider that it might be based on a misidentification.

107. **Biermannia** King & Pantling

Plants small, monopodial, epiphytic. *Stems* short. *Leaves* fleshy, linear, unequally 2-lobed, lobules acute. *Inflorescence* racemose, short. *Flowers* small, resupinate. *Sepals* subequal; *lateral sepal* attached to column base. *Lip* sessile, narrowly but firmly adnate to the column foot and attached at right-angles, sides enveloping or parallel with the column, base of lip with a small slit-like opening leading to a small hidden pouch; spur absent. *Column* with a short foot; pollinia 2, ovoid, slightly grooved or with a small cavity; stipes linear-oblong.

The genus *Biermannia* was established in 1897 by George King & Robert Pantling in the *Journal of the Asiatic Society of Bengal*. The genus comprises about nine species distributed in India, Thailand, Peninsular Malaysia, Sumatra, Java, Bali and Borneo.

TYPE. *Biermannia quinquecallosa* King & Pantling.
ETYMOLOGY. Named after Adolph Biermann, one time Curator of the Calcutta Botanic Garden.

1. B. bimaculata (King & Pantling) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 200, t.267 (1898). Type: Sikkim, Teesta (Tista), *Pantling* 209 (holo. CAL, iso. K!).
Sarcochilus bimaculatus King & Pantling in J. Asiat. Soc. Bengal 64(3): 340 (1896).

Plant to 7.5cm tall. *Stem* covered by leaf sheaths, 0.5–0.8cm long. *Leaves* linear-oblong, weakly falcate, apex obliquely 2-lobed, sessile, jointed, 2.8–7.5 × 0.6–1cm. *Inflorescence* stout, compressed, flowering in upper half of rachis, 2- or 3-flowered; peduncle glabrous, lamellate, sheathed, 1–2cm long; sheaths alternate, triangular-acute, 1–2mm long; floral bracts broad. *Flowers* distichous, 8–9mm across, white with two brown blotches on the lip callus; pedicel and ovary 4–5mm long. *Sepals* subsimilar, ovate-lanceolate, apiculate, c.8 × 2mm; *lateral sepals* attached to column foot. *Petals* ovate, subacute, c.6 × 1.5mm. *Lip* 3-lobed, at right-angles to the column foot, lying parallel to the column, c.4mm long; lateral lobes narrow, elongate, falcate, erect, acuminate; mid-lobe triangular, very fleshy; disc with 2 elongate basal calluses and 2 flat calluses at base of mid-lobe. *Column* 1–2mm tall; foot short, at right-angles to column; stigma large. *Fruit* 3-angled, ovoid, 3.5 × 1.5mm. **Fig. 110.**

Sikkim (Tista River). In tropical valleys; 500m. Fl. May–July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin bi- (two) and *maculatus* (spotted) in reference to the lip callus.
NOTES. The type material of this species is in very poor condition and careful floral examination has proved impossible. It is related to the Vietnamese *B. sigaldii* Seidenfaden.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

B. jainiana Hegde & A.N. Rao in Bull. Bot. Surv. India 26(1–2): 97 (1984). Type: India, Arunachal Pradesh, W Kameng District, Sessa, *Hegde* 4192 (holo. Orchid Herbarium Tipi).

NOTES. This species has been reported from Sessa in the W Kameng district of Arunachal Pradesh, it is related to *B. quinquecallosa* King & Pantling but the latter species has smaller leaves, an axillary inflorescence, is 1- or 2-flowered and has an epichile with 4 transverse calluses; it differs from *B. bimaculata* in its simple lip. We have seen no material of this species.

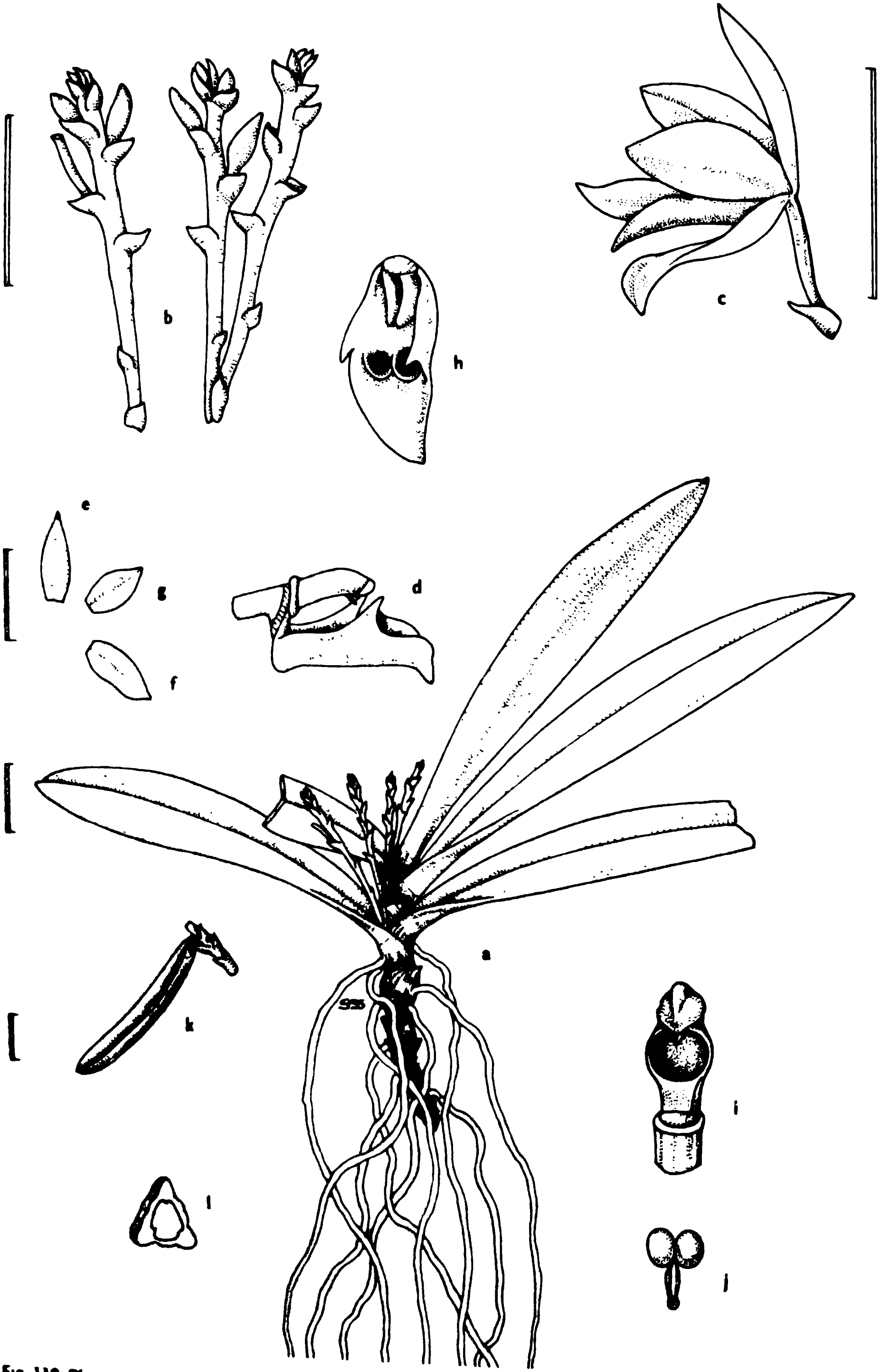

Fig. 110. **Biermannia bimaculata**: a, habit; b, inflorescence; c, flower; d, lip and column; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column; j, pollinarium; k, fruit; l, fruit (cross section). Drawn by Susanna Stuart-Smith, a–c from *Pantling* 209 (K); d–l from t.267 in King & Pantling (1898).

108. Chiloschista Lindl.

Plants epiphytic or lithophytic, usually stemless and leafless; *roots* flat, scabrid, green, photosynthetic. *Inflorescence* racemose. *Flowers* ephemeral. *Sepals* and *petals* subequal; lateral sepals and petals often adnate to column foot. *Lip* ± clawed, hinged to apex of column foot, pouched or spurred, 3-lobed; lateral lobes large, erect; mid-lobe small; disc with a finger-like callus, hirsute-pubescent. *Column* short; semiterete; column foot long; clinandrium shallow; stigma deep-set; rostellum deflexed, bifid; anther cap with 2 long-filiform setae; pollinia 4, in 2 closely appressed, unequal, sessile pairs; stipe sublinear.

The genus *Chiloschista* was established in 1832 by John Lindley in the *Botanical Register*. The genus comprises about 10 species distributed from the Indian subcontinent through SE Asia and Australia.

Diels & Mansfeld (1932) and Seidenfaden (1988) have reviewed the genus.

TYPE. *Chiloschista usneoides* (D. Don) Lindl.; basionym: *Epidendrum usneoides* D. Don.
ETYMOLOGY. From the Greek *cheilos* (lip) and *chistos* (cleft).

Key to species

1. Sepals and petals yellow with broad red spots, pubescent externally .... 1. **C. parishii**
+ Sepals and petals pink to white, not pubescent externally .... 2. **C. usnseoides**

1. **C. parishii** Seidenfaden in Opera Bot. 95: 176, t.109 (1988). Type: Myanmar (Burma), Moulmein. *Parish* 55 (holo. W! Herb. no. 26237, iso. [with icon.] K!).
Thrixspermum luniferum sensu Rchb. f. in Trans. Linn. Soc. London 30: 136 (1874), *non* Rchb. f. (1868).

Plant epiphytic; *roots* numerous, elongate, 2–3mm wide. *Inflorescence* pendent, pubescent, laxly many-flowered; peduncle sheathed, hirsute, 1.4–2.5cm long; sheaths distant, lanceolate, acute, membranous, 2–3mm long; rachis softly hirsute, 2.5–8cm long; floral bracts ovate-laceolate, membranous, 2–3 × 1–1.5mm. *Flowers* subsessile, 1.2–1.3cm across; sepals and petals yellow with large brown to red spots or blotches, lip yellow with broad bands of brown; pedicel and ovary subsessile, pubescent, 2–3mm long. *Dorsal sepal* ovate, obtuse, concave, arching over the column, outer surface hirsute, 5–6 × 3–4mm; *lateral sepals* ovate-orbicular, obtuse, spreading, outer surface hirsute, 5–6 × 1.5–3.5mm. *Petals* subquadrate, truncate, outer surface hirsute, 4–5 × 3–4mm. *Lip* deeply saccate, parallel to the column, adnate to the column foot, 3-lobed; lateral lobes large, erect, obliquely oblong, glabrous, 2.5–3 × 0.8–1.2mm; mid-lobe knob-like, reduced; sac 1.5–2mm long; disc with a pubescent ridge. *Column* thick, 1–1.2mm long; foot c.3mm long; anther cap with 2 long, filiform, decurved lateral setae, c.1.5–2mm long. *Fruit* fusiform-cylindric, 1.6–2.8 × 0.2–0.3cm.

Bhutan: S – Chukka (Marichong) and Gaylegphug (Surelakha) districts; C – Thimphu (Cheri Gompa/Changri Monastery) and Tashigang (Chorten Kora) districts; **Terai** (Sukna); **Darjeeling** (Mt. Ghose, Kalimpong, Nimbong); **Sikkim** (Tumlong). On branches in dense rain-forest, on *Panax pseudoginseng*; 660–1800m. Fl. April–May(–June).

GENERAL DISTRIBUTION. Nepal, NE India and Myanmar.
ETYMOLOGY. Named in honour of Charles Parish (1822–1897) who collected the type specimen.
NOTE. This plant was included by earlier authors in *C. lunifera* (Rchb. f.) J.J. Smith, but the Nepalese and NE Indian plants were separated as *C. parishii* by Seidenfaden (1988).

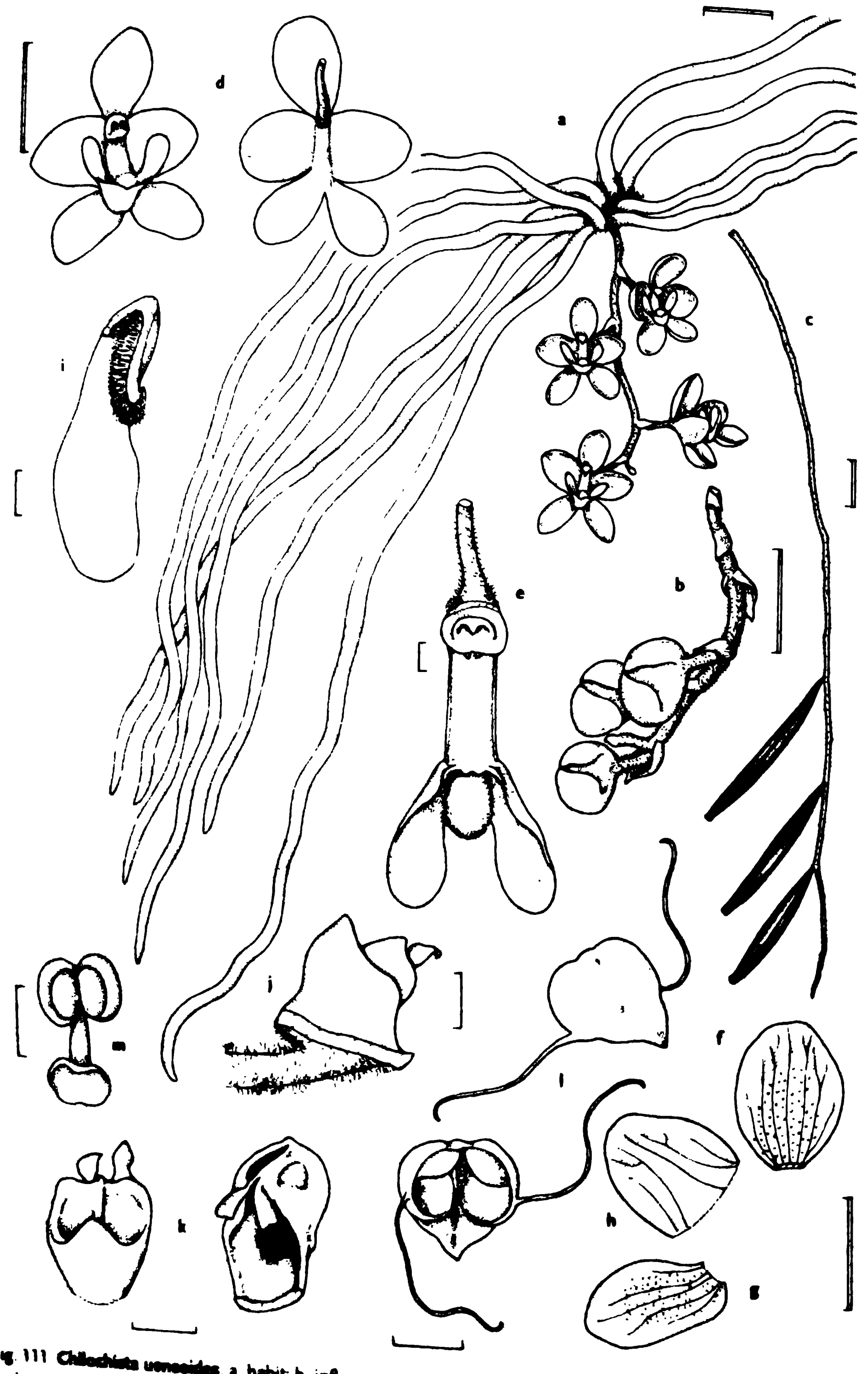

Fig. 111 **Chiloschista usneoides**. a, habit; b, inflorescence; c, infructescence; d, flower (two views); e, lip, column and ovary; f, dorsal sepal; g, lateral sepal; h, petal; i, lip (sectioned to show disc); j, column (side view); k, column apex (two views); l, anther (two views); m, pollinarium. Drawn by Susanna Stuart-Smith, a–b and d–m from *Ludlow et al.* 20644 (K); c from *Hooker* 192 (K).

2. C. **usneoides** (D. Don) Lindl. in Bot. Reg. 18: sub t.1522 (1832). Type: Nepal, *Buchanan-Hamilton* s.n. (holo. BM ?lost); Neotype: Nepal, coll. *Wallich* Wall. Cat. 7330 (K-LINDL!, iso. K-W!), designated by Seidenfaden in Opera Bot. 95: 175 (1988).
Epidendrum usneoides D. Don, Prodr. Fl. Nepal: 37 (1825).
Aerides convallarioides Wall. ex Lindl., Sert. Orchid. 1: 4 (1837), *in syn.*
Sarcochilus usneoides (D. Don) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 497 (1863).
Thrixspermum usneoides (D. Don) Rchb. f., Xenia. Orchid. 2: 120 (1867).

Plant epiphytic or lithophytic, pendent; *roots* tufted, long, twisted. *Inflorescence* many-flowered; peduncle brownish, pubescent, sheathed, 5–9mm long; sheaths ovate, acute, membranous, clasping, 3.5 × 2mm; rachis flexuous, pubescent, 0.5–2cm long; floral bracts lanceolate-obcordate, acuminate, membranous, 4 × 1.5mm. *Flowers* subsessile, lightly fragrant, 0.5–1.3cm across, pink to white; pedicel and ovary densely hirsute-pubescent, c.5mm long. *Sepals* similar, oblong, obtuse, 5-veined, 6 × 4mm. *Petals* spreading, ovate, obtuse, 5-veined, 6 × 4–5mm. *Lip* gibbous-saccate at base, clawed; lateral lobes linear-oblong, obtuse, 4–5 × 2–2.5mm; mid-lobe truncate, emarginate; sac 2 × 3.5mm; disc between lateral lobes densely pubescent. *Column* 1.5–2mm; anther cap with 2–3 setae. *Fruit* weakly curved, cylindric, glabrous, 3.5–7.5 × 0.3–0.5cm. **Fig. 111.**

Bhutan: C – Tongsa (Jingang Chu Valley, Shemgang, Tingtinbi) and Tashigang (Tashi Yangtsi Dzong) districts; **Sikkim** (unlocalised *Hooker* spcimens). In oak and evergreen forest; 700–1830m. Fl. April.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, E Himalaya and ?Thailand.
ETYMOLOGY. From *Usnea* (a genus of lichen) and the Greek suffix *-oides* (indicating a resemblance).

109. **Cleisocentron** Brühl

Plants epiphytic, monopodial. *Stems* long, pendent. *Leaves* oblong, terete, apex unequally 2-lobed to acute. *Inflorescence* supra-axillary, racemose, short, few- to many-flowered. *Sepals* and *petals* spreading. *Lip* immobile, 3-lobed; spur gently curved, cylindric, containing either an upward-pointing, central protuberance on the back wall, or a decurved, shelf-like back wall callus, front wall callus flap-like, median septum absent. *Column* erect, cylindric; foot decurrent on back wall of the lip or free; stipes long, slender; viscidium large; pollinia 4, as 2 pollen masses, each completely divided into free halves.

The genus *Cleisocentron* was established in 1926 by Paul Brühl in his *Guide to the Orchids of Sikkim*. The genus comprises about five species distributed from Sikkim, Bhutan, Myanmar and Vietnam to Borneo.

LECTOTYPE. *Saccolabium trichromum* Rchb. f. = *Cleisocentron pallens* (Cathcart ex Lindl.) N. Pearce & P.J. Cribb; basionym: *Saccolabium pallens* Cathcart ex Lindl.
ETYMOLOGY. From the Greek *cleiso-* (hook or tongue) and *centron* (sharp point) in reference to the projection within the spur.

1. C. **pallens** (Cathcart ex Lindl.) N. Pearce & P.J. Cribb in Edinb. J. Bot. 58(1): 118 (2001). Type: India, Sikkim, icon. Cathcart (holo. K!).
Saccolabium pallens Cathcart ex Lindl. in J. Proc. Linn. Soc., Bot. 3(9): 35 (1858).
S. trichromum Rchb. f. in Hamburger Garten-Blumenzeitung 15: 51 (1859). Type: Himalayas, without precise locality, cult. Strange (holo. W! Herb. no. 19140, iso. W! no. 19141).
Cleisocentron trichromum (Rchb. f.) Brühl., Guide Orchids Sikkim: 137 (1926).

Plant 30–100cm long. *Stem* branched, covered with fibrous leaf sheaths. *Leaves* 10–12, narrowly oblong, tapering slightly, apex obliquely bifid, sessile, jointed, 8–15 × 1.3–1.8cm. *Inflorescence* divergent, secund, few-flowered; peduncle sheathed at base, 1–1.5cm long; sheaths tubular, 4–5mm

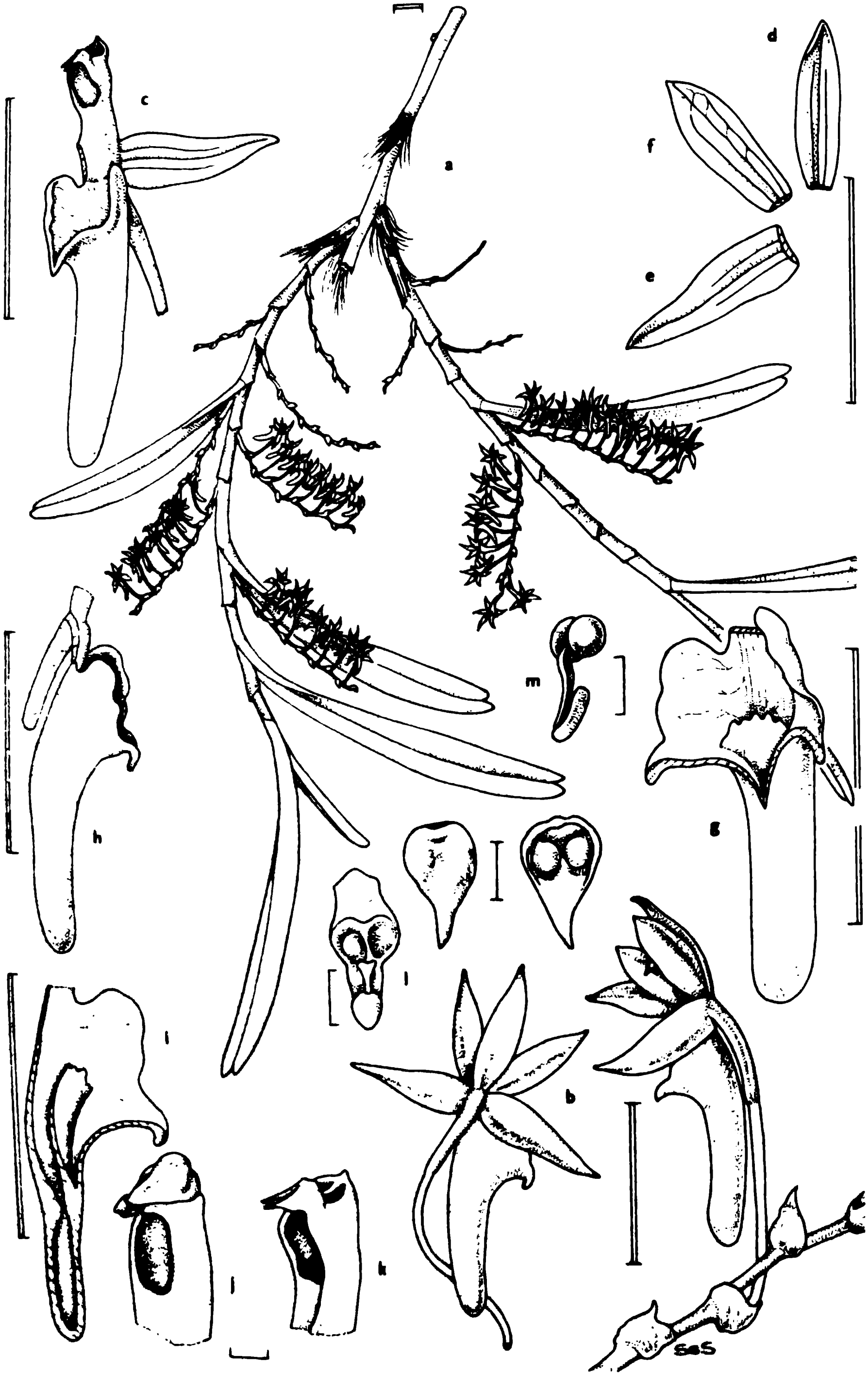

Fig. 112. **Cleisocentron pallens**: a, habit; b, flower with part of inflorescence (two views); c, lip, column and lateral sepal; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip (side view); i, lip (sectioned); j, column; k, column (with anther removed); l, anther (three views); m, pollinarium. Drawn by Susanna Stuart-Smith from *Pantling* 92 (K).

long; rachis glabrous 3–7cm long; floral bracts broad, obtuse, 3–4mm long. *Flowers* c.2.6cm across; sepals and petals pale straw-coloured, lined with pale pink, spur pink, column white: pedicel and ovary slender, 1.6–3cm long. *Sepals* subsimilar, spreading, narrowly oblong, subacute, 6–8 × 1.5–2mm; *lateral sepals* oblong-lanceolate, acute, 8–9 × 2–3mm. *Petals* obovate-oblong, apiculate, 5–6 × 1.5–2mm. *Lip* adnate to the column foot, 3-lobed, long-spurred, 1.3–1.7 × 0.2–0.5cm (with spur); lateral lobes broadly triangular; mid-lobe short, triangular, concave, acute, entire, ecallose; spur funnel shaped, slightly curved, obtuse, with 2 large projecting calluses half way down the tube; front wall callus projecting upwards as a plate dividing the upper spur into 2 chambers. *Column* 4 × 2mm; column foot curved, c.2mm long; anther cap depressed, beaked in front. **Fig. 112.**

Sikkim (unlocalised *Pantling* specimens). 330–630(–2000)m. Fl. July–August.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *pallens* (pale) in reference to the flower colour.
NOTE. Pearce, Cribb & Renz (2001) reviewed the confused taxonomy of this species.

110. Cleisostoma Bl.

Plants epiphytic or occasionally lithophytic, small to medium-sized, monopodial. *Stems* to 60cm long. *Leaves* dorsi-ventrally flattened or terete, apex 2-lobed or acute. *Inflorescence* usually paniculate, erect, horizontal or pendent, few- to many-flowered. *Flowers* small, subtended by small bracts. *Sepals* and *petals* similar, free, spreading. *Lip* 3-lobed, saccate to spurred, with a callus on the back wall and often with outgrowths on the front wall closing the entrance; *spur* with or without a septum. *Column* short and stout, lacking a foot; viscidium variable, small and subglobose to broad and horseshoe-shaped; pollinia 4, appearing as 2 unequal masses.

The genus *Cleisostoma* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises about 100 species distributed from Sri Lanka, India, SE Asia, Indonesia, New Guinea, the Philippines and the Pacific Islands to Australia.

The revision of the Thai species by Seidenfaden (1975b) has been the basis of all subsequent work on this difficult genus, and a more thorough synonymy can be found therein. He proposed a division into seven sections and this treatment is followed here.

TYPE. *Cleisostoma sagittatum* Bl.
ETYMOLOGY. From the Greek *cleistos* (closed) and *stoma* (mouth), a reference to the mouth of the lip which is narrowed by callosities.

Key to species

1. Leaves dorsi-ventrally flattened 2
+ Leaves terete 7

2. Pollinia with complex stipes .... **6. C. striatum**
+ Pollinia with simple linear or clavate stipes 3

3. Leaf apex acute, not 2-lobed .... **5. C. subulatum**
+ Leaf apex 2-lobed 4

4. Leaf apex lobules broadly rounded-obtuse 5
+ Leaf apex lobules acute to acuminate 6

5. Operculum of anther truncate .... **3. C. linearilobulatum**
+ Operculum of anther with a triangular, acute tip .... **4. C. racemiferum**

6. Mid-lobe of lip fleshy, obtuse, margins simple; lateral lobes of lip triangular, obtuse ..... 1. C. **aspersum**
+ Mid-lobe of lip thin-textured, truncate, margins erose; lateral lobes of lip large and broad ..... 2. C. **discolor**

7. Stipes of pollinia mitre-shaped ..... 7. C. **williamsonii**
+ Stipes of pollinia not mitre-shaped 8

8. Stipes slender, simple; viscidium disc-like, simple ..... 8. C. **filiforme**
+ Stipes complex; viscidium complex, 2-armed ..... 9. C. **simondii**

Section **Cleisostoma**

1. C. **aspersum** (Rchb. f.) Garay in Bot. Mus. Leafl. 23(4): 169 (1972). Type: Myanmar (Burma), Moulmein, *Veitch* 39 (holo. W! Herb. no. 53509).

Sarcanthus aspersus Rchb. f. in Hamburger Garten-Blumenzeitung 21: 297 (1865).

Cleisostoma bicuspidatum Hook. f., Fl. Brit. India 6(1): 75 (1890). Type: India. Khasia Hills, *Mann* 56 (holo. K!).

Stereochilus bicuspidatum (Hook. f.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 236, t.314 (1898).

Sarcanthus bicuspidatus (Hook. f.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 84 (1912).

S. khasiaensis T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 98 (1951), nom. alt.

Plant 10–35cm tall; *roots* basal, clustered. *Stem* covered by leaf sheaths, 1–7cm long; sheaths overlapping, 6–9mm long. *Leaves* 4–7, subflabellate, coriaceous, oblong, deeply obliquely 2-lobed at apex, lobules unequal, rounded to acute, entire to erose, narrowed to grooved base, jointed, 6–18 × 0.9–1.6cm. *Inflorescence* axillary, from base of leaf sheaths, long, slender, branched (occasionally simple), subdensely many-flowered; peduncle slender, glabrous, sheathed at base and above, variable, 6–15 × 0.05–0.1cm; sheaths tubular at base, the upper distant, ovate, acute, 1–2mm long; rachis glabrous, 3–18cm long; floral bracts ovate-triangular, acute, 0.5–1mm long. *Flowers* 4–6mm across, uniformly yellowish with pink markings along midrib of sepals and petals and lobes of lip; pedicel and ovary glabrous, 2–3mm long. *Dorsal sepal* obovate-elliptic, obtuse, 3-veined, 2.5–3 × 0.6–1.2mm; *lateral sepals* broadly elliptic, obtuse, 3-veined, 2.5–3 × 1–1.5mm. *Petals* oblanceolate, obtuse, 3-veined, 2.5–3 × 1–1.5mm. *Lip* adnate to the column, spurred, 3-lobed, 2–3mm long; lateral lobes triangular, obtuse; mid-lobe broadly ovate, concave, acute; base with 2 cushion-like calluses at sides of lateral lobes; *spur* prominent, mouth funnel shaped, cylindric, glossy, septum at brim occlusive, 2–3 × 1mm. *Column* c.1mm tall; rostellum large. *Fruit* ovoid, 1–1.5 × 0.3–0.4cm.

Bhutan: C – Punakha district (Samtengang to Chusom); **Sikkim** (unlocalised *Pantling* specimen). In tropical valleys; 1300–1900m. Fl. April–August; Fr. August.

GENERAL DISTRIBUTION. NE India and Myanmar.

ETYMOLOGY. From the Latin *aspersus* (sprinkled) in reference to the spotted lip.

2. C. **discolor** Lindl. in Bot. Reg. 31: misc.59, no.61 (1845). Type: India, *Loddiges* s.n. (holo. K, probably lost).

Saccolabium rostellatum Hook. f., Fl. Brit. India 6(1): 59 (1890). Type: India, Darjeeling, *Gamble* 188 (holo. CAL, icon.K!).

Sarcanthus discolor (Lindl.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 85 (1912).

Plant pendent. *Stem* short, covered by leaf sheaths. *Leaves* oblong, apex unequally 2-lobed, lobules triangular, obtuse, sessile, jointed, 11–16 × 0.8–2cm. *Inflorescence* paniculate, laxly 8- to 16-flowered; peduncle glabrous, sheathed; sheaths distant, broadly ovate-triangular, acute, deep purple, 3–4 × 3mm; rachis glabrous, deep purple, 5–11cm long; floral bracts triangular, 1–1.5 × 0.5–0.8mm. *Flowers* 6–8mm across; sepals and petals dull yellowish-green, green to greenish-white with a purple vein, lip greenish-white with purple blotches, spur white; pedicel and ovary 3–4mm long. *Dorsal sepal* oblong to ovate, rounded, 5-veined, 4–5 × 2–3mm; *lateral sepals* similar, 3-veined, 4–5 × 2–3mm. *Petals* oblong-ovate, obtuse to subtruncate, 3-veined, 3–4 × 1.5–2mm. *Lip* 3-lobed, spurred, 4–5mm long; lateral lobes large, flat, broad, semi-circular, truncate, margins crenulate, apex incurved, acute; mid-lobe spathulate-truncate, apex deflexed, margins erose; disc with a back wall callus, obtriangular with a median ridge; spur conical, curved, narrowed towards apex, semi-septate, 3–4 × 1–2mm. *Column* stout, 2mm long; anther cap long-beaked, keeled, 2mm long.

Darjeeling (unlocalised *Gamble* specimen). 2300m. Fl. July–August.

GENERAL DISTRIBUTION. India (Deccan), Thailand, Cambodia, Malaysia, Sumatra and Java.
ETYMOLOGY. From the Latin *discolor* (of different colours).

3. C. **linearilobulatum** (Seidenfaden & Smitinand) Garay in Bot. Mus. Leafl. 23(4): 172 (1972).
Type: Thailand, Kawng He, Chiengmai, *Kerr* 363 (holo. K!).
Sarcanthus sagittatus King & Pantling in J. Asiat. Soc. Bengal 66(3): 595 (1897), *nom. illeg.* Type: India, Khasia, *Pantling* 629 (holo. CAL).
S. linearilobulatus Seidenfaden & Smitinand, Orchid Thailand 4(2): 684, f.506 (1965).
Cleisostoma sagittiforme Garay in Bot. Mus. Leafl. 23(4): 174 (1972).
C. sikkimense S.Z. Lucksom in Indian J. Forest. 15(1): 27 (1992), **syn. nov.** Type: India, Sikkim, Leeving, *Lucksom* 204A (holo. BHSC).

Plant 15–25cm tall; *roots* thick, clustered. *Stem* covered by leaf sheaths, 1.5–3.5cm long. *Leaves* distichous, apex unequally 2-lobed, lobules rounded, 7–12 × 1.3–1.9cm. *Inflorescence* lateral, paniculate, laxly many-flowered; peduncle sheathed, glabrous, 8–10cm tall; sheaths 3, distant, tubular, 4–6mm long; rachis glabrous, 6–10cm long; floral bracts ovate, acute, c.1–1.5mm long. *Flowers* 4–6mm across; dorsal sepal and petals reddish-brown, lateral sepals red-brown and green, lip pink; pedicel and ovary straight, glabrous, 3.5–4mm long. *Sepals* similar, oblong-lanceolate, subacute, 2.5 × 1.5mm. *Petals* oblong, obtuse to subacute, 2 × 0.8mm. *Lip* 3-lobed; lateral lobes narrowly triangular, with porrect tips, papillose at entrance to spur, c.2mm long; mid-lobe sagittate, broad-tipped, wing tips recurved; spur concave, septate half-way up inside and continuing in a ridge half-way out on mid-lobe, c.3.5mm long; callus on back wall with a median furrow, 2-horned. *Column* slender, 0.8–1mm tall; rostellum parted medially with 2 curving plates; stipes linear, simple. *Fruit* stalked, ovoid, 1.5 × 0.6mm; stalk 2–3mm long. **Fig. 113; Plate 27.**

Bhutan: C – Punakha district (between Wache and Ngawang); **Sikkim** (Leeving, Namchebong, Rumtek (Lucksom, 1992)). In shade on *Castanopsis tribuloides*; 500–2000m. Fl. May–June; Fr. August–September.

GENERAL DISTRIBUTION. NE India, China (Yunnan) and Thailand.
ETYMOLOGY. From the Latin *linearis* (narrow) and *lobulatus* (lobuled) in reference to the lateral lobes of the lip.
NOTES. Seidenfaden (1995a) elucidated the taxonomy of this species. The single Bhutanese record is based on a Grierson & Long collection which has features consistent with *C. linearilobulatum*, but in which the leaves have distinctly pointed apices (see illustration). E.A. Christenson has examined the collection and is convinced (pers. comm.) that it belongs here, but further collections are required. Lucksom considered his *C. sikkimense* to be closely allied to *C. subulatum*, but following the sectional

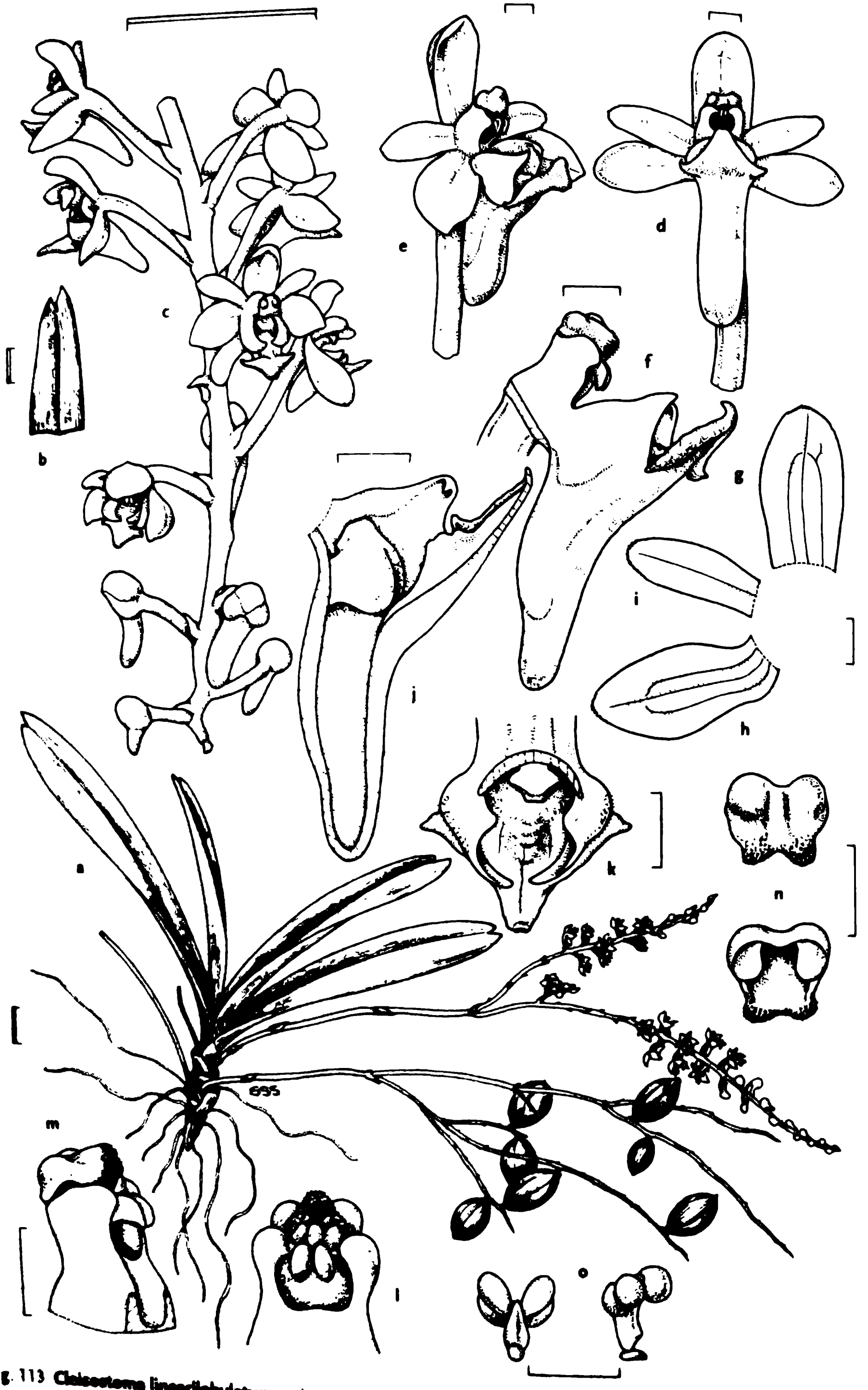

Fig. 113 **Cleisostoma linearilobulatum**: a, habit; b, leaf apex; c, inflorescence; d, flower (front view); e, flower (side view); f, lip and column (side view); g, dorsal sepal; h, lateral sepal; i, petal; j, lip (sectioned); k, lip apex (top view); l, column (front view); m, column (side view), n, anther (two views); o, pollinarium (two views). Drawn by Susanna Stuart-Smith, a from *Kerr* 363 (K); b–o from *Grierson & Long* 4562 (E).

criteria of Seidenfaden (1975b) the species should be included in section *Cleisostoma*, and we are unable to distinguish it from C. *linearilobulatum*.

4. C. **racemiferum** (Lindl.) Garay in Bot. Mus. Leafl. 23(4): 173 (1972). Type: India, icon. Wallich 655 (holo. K!).
Saccolabium racemiferum Lindl., Gen. Sp. Orchid. Pl.: 224 (1833).
Sarcanthus pallidus Lindl. in Bot. Reg. 26: misc.78, no.185 (1840). Type: India, cult. Gibson (holo. K-LINDL!).
S. *racemifer* (Lindl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 891 (1861).
S. *yunnanensis* Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 77 (1919). Type: China, Yunnan, *Henry* s.n. (holo. B).

Roots robust, piercing through bases of leaf sheaths, 4–5mm wide. *Stem* covered by leaf sheaths, 0.7–1.2cm wide; sheaths overlapping, 2–3cm long. *Leaves* oblong, spreading, coriaceous, keeled beneath, apex unequally 2-lobed, lobules broadly rounded, sessile, jointed, 14–36 × 1.8–3.5cm. *Inflorescence* lateral, leaf-opposed, paniculate, laxly many-flowered; peduncle sheathed, glabrous, 15–25cm long; sheaths tubular at base, the upper ones distant, broadly ovate, subacute, 3–4 × 1.5–2mm; rachis 10–19cm long; floral bracts elliptic-lanceolate, acute, 1.5–4 × 0.5–1mm. *Flowers* 6–8mm across; sepals and petals brownish-black, edged with yellow, lip yellowish, column white; pedicel and ovary 0.3–1cm long. *Dorsal sepal* elliptic, rounded, spreading, 3–5 × 1–2.5mm; *lateral sepals* oblique, obtuse, spreading, 3–4 × 1.5–2mm. *Petals* elliptic, rounded, 3–4 × 2–3mm. *Lip* 3-lobed, fleshy, spurred, 4–5mm long; lateral lobes obliquely triangular, acuminate; mid-lobe fleshy, triangular, narrowly incurved, longitudinally hollowed centrally; back wall callus rounded, 2-lobed, papillose; spur slightly incurved, subcylindric, semi-septate, 3–4 × 1.5–1.8mm. *Column* stout, 2mm tall; anther cap beaked, 0.5mm long. **Plate 27.**

Bhutan: S – Phuntsholing/Chukka district (Chima Kothi to Phuntsholing); C – Punakha (Bhotokha to Rimchu, below Tinlegang), Mongar (Khoma) and Tashigang (Shali (M.F.B.), 7km before Tashi Yangtsi) districts; **Sikkim** (Gangtok, Tendong). In evergreen oak forest and on *Quercus griffithii*; 800–2150m. Fl. May–June; Fr. October.

GENERAL DISTRIBUTION. India, Nepal, Myanmar, China, Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *racemosus* (flowers arranged in a raceme) and *-ferus* (bearing).

Section **Subulatum** Seidenfaden in Dansk Bot. Ark. 29(3): 45 (1975).

5. C. **subulatum** Bl., Bijdr.: 363 (1825). Type: Java, Tjilele, Parang, Tjanjor, *Blume* s.n. (holo. L!).
Sarcanthus secundus Griff., Not. Pl. Asiat. 3: 362 (1851); Icon. Pl. Asiat. 3: t.336 (1851). Type: India, Assam, Suddyah, icon. Griffith (holo. plate cited here).
Sarcanthus subulatus (Bl.) Rchb. f. in Bonplandia 5: 41 (1857).
Saccolabium secundum (Griff.) Ridley, Mat. Fl. Malay. Penins. 1: 168 (1907).

Plant pendent. *Stem* slender, compressed, covered by leaf sheaths; sheaths tubular, 1.5–2cm long. *Leaves* distichous, fleshy, linear-oblong to oblong-lanceolate, 1-ribbed beneath, apex gradually and finely acuminate, abruptly narrowed towards channelled base, jointed, sheathed, 8.5–30 × 0.6–1.1cm. *Inflorescence* lateral (axillary), leaf-opposed, pendent, racemose, laxly 5- to many-flowered; peduncle glabrous, sheathed at base, 0.7–2cm long; sheaths tubular; rachis glabrous, 2–11cm long; floral bracts ovate, subacute, scale-like, 1–1.2 × 0.4–0.5mm. *Flowers* scentless, 3–5mm long; sepals and petals pale yellow with intra-marginal bands of golden to red-brown, lip white with purple-pink apical lobe; pedicel and ovary glabrous, 2–2.5mm long. *Sepals* similar, ovate-elliptic to ovate-spathulate, subacute, spreading, 4–5 × 1.5–2mm. *Petals* obovate-oblong, obtuse, spreading, 3–4 × 1–1.5mm. *Lip* fleshy, adnate to the column base, saccate-spurred, 3–4mm long; hypochile with 2 short, suborbicular to triangular lateral lobes; epichile concave, oblong, acute; *spur* funnel shaped, obtuse, septate and bearing a bulbous, projecting callus from front and back walls, 3–4 × 1–1.5mm. *Column* very short, stout, semi-terete, lacking a foot; anther cap depressed, long-beaked; caudicle long, tapering; stigma obovate. *Fruit* ellipsoid, 3-ridged, 1.2–1.8 × 0.4–0.5cm. **Plate 28.**

Bhutan: S – Sarbhang district (Singi Khola 10km SW of Sarbhang); **Sikkim** (unlocalised *Pantling* specimens). In subtropical valleys and terai forest; 390m. Fl. March–July.

GENERAL DISTRIBUTION. NE India, Myanmar, Thailand, Cambodia, Malaysia, Indonesia and the Philippines.
ETYMOLOGY. From the Latin *subulatus* (awl-shaped) in reference to the leaf apex.

Section **Echioglossum** (Bl.) Seidenfaden in Dansk Bot. Ark. 29(3): 40 (1975).

6. C. **striatum** (Rchb. f.) N.E. Brown in G.W. Johnson, Suppl. Gard. Dict.: 901 (1882). Type: India, Darjeeling, cult. MacLeary/Green 728 (holo. W! Herb. no. 53401).
Echioglossum striatum Rchb. f. in Gard. Chron. n.s. 12: 390 (1879).
Cleisostoma brevipes Hook. f., Fl. Brit. India 6(1): 73 (1890). Types: India, Darjeeling, *Gamble* 10452 (syn. K!); Assam, cult. (syn. K!).
Sarcanthus brevipes (Hook. f.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 84 (1912).
S. striatus (Rchb. f.) J.J. Smith, *loc. cit.* (1912).

Plant pendent; roots arising from nodes, grey. *Stem* covered by leaf sheaths, 11–37cm long; internodes 1–2.5cm long; sheaths tubular, rugose, mouth wide. *Leaves* distichous, linear-lanceolate, fleshy-rigid, apex acute, sessile, jointed-mucronate, 5.5–16 × 0.7–1.6cm. *Inflorescence* lateral, axillary, short, stout, laxly 5- to 11-flowered; peduncle thick, sheathed at base, 5–6mm long; sheaths 2, annular, overlapping, broadly ovate, 2–3mm long; rachis thick, 2–3.5cm long; floral bracts ovate to triangular, subacute, 1–2 × 1–1.8mm. *Flowers* 7–8mm across; sepals and petals golden with 2 purple stripes, lip pale yellow with a white apex; pedicel and ovary glabrous, 3–4mm long. *Dorsal sepal* ovate, obtuse, hooded, 5-veined, 5–6 × 2–2.5mm; *lateral sepals* spreading, ovate, obtuse, 5-veined, 4–5 × 2–2.5mm. *Petals* lanceolate-ovate, obtuse, 5-veined, 4–5 × 1.5–2mm. *Lip* 3-lobed, 4–7mm long; hypochile deeply saccate-spurred, lateral lobes short, triangular, falcate, acute; epichile short, hastate, sigmoid, apex aristate-elongate, bicuspidate (or not), c.4mm long; *spur* saccate, orbicular, 1.5–2mm wide. *Column* lacking a foot, broadly winged, 1.5–2mm long; stipe horseshoe-shaped at base. *Fruit* fusiform, striate, 2.6–3 × 0.6–0.8cm.

Darjeeling (Rangit); **Sikkim** (unlocalised *Pantling* specimen). 1660m. Fl. June–August; Fr. August.

GENERAL DISTRIBUTION. NE India, China, Thailand, Vietntnam and Malaysia.
ETYMOLOGY. From the Latin *striatus* (striped) in reference to the sepals and petals.
NOTE. Seidenfaden (1995a) treated *Saccolabium rugulosum* Ridley as distinct from *Cleisostoma striatum*, making the new combination *C. rugulosum* (Ridley) Seidenfaden; we agree with this treatment.

Section **Mitriformes** Seidenfaden in Dansk Bot. Ark. 29(3): 45 (1975).

7. C. **williamsonii** (Rchb. f.) Garay in Bot. Mus. Leafl. 23(4): 176 (1972). Type: India, Assam, icon. Williamson (holo. W!).
Sarcanthus williamsonii Rchb. f. in Gard. Chron. 1865: 674 (1865).
C. elegans Seidenfaden in Dansk Bot. Ark. 29(3); 46 (1975), **syn. nov.** Type: Myanmar, Moulmein, *Parish* 272 (holo. W!, icon. K!).
Echioglossum williamsonii (Rchb. f.) Szlachetko, *loc. cit.* (1995).

Plant sometimes lithophytic, clustered, pendent, 35–45cm long; *roots* basal, caespitose. *Stem* covered by leaf sheaths, 2–3mm wide; sheaths tubular, ridged, overlapping, 1.5–2cm long. *Leaves* distichous, linear-terete, rugose, apex obtuse, sessile, 9–13 × 0.1cm. *Inflorescence* lateral from half-way down leaf-sheath, racemose or paniculate, pendent, laxly many-flowered; peduncle sheathed at base, 1cm long; sheath tubular, 2mm long; rachis glabrous, 5–9cm long; floral bracts triangular, 1 × 0.5mm. *Flowers* 3–5mm across; sepals and petals pink, lip pale purple; pedicel and ovary slender, 2–3mm long. *Dorsal sepal* ovate, subacute, hooded, 2.5 × 1mm; *lateral sepals* spreading, elliptic-ovate, obtuse, 2.5–3 × 1–1.5mm. *Petals* lanceolate-ovate, subacute, 2 × 0.8mm. *Lip* 3-lobed, spurred, 2–3mm long (in natural position); hypochile globose saccate, lateral lobes oblong, rounded, 0.8 × 0.2mm; epichile decurved, lanceolate, apex curved inwards; *spur* globose, 1.5 × 1mm; back wall callus 2-lobed with side horns. *Column* 1mm long; stipe mitre-shaped, base broad. *Fruit* ovoid, ridged, 5–7 × 3–4mm. **Plate 28.**

Bhutan: C – Punakha (Rimchu), Tongsa (Mangde Chu Valley, 11km from Shemgang) and Tashigang (Nagton, near Tashi Yangtsi) districts. On dry rock face in broad-leaved and *Pinus roxburghii* forest, in hot dry valleys; 1160–1910m. Fl. May.

GENERAL DISTRIBUTION. NE India, Myanmar, China, Thailand, Vietnam, Malaysia, Sumatra, Java and Borneo.

ETYMOLOGY. Named after W.J. Williamson who collected orchids in Assam (India) and drew the type illustration.

NOTES. Seidenfaden (1975b) described *C. elegans* from Moulmein (Myanmar), based on a Parish collection. The species is closely related to *C. williamsonii* but has an 'incurved drawn out slender spathulate apex of the mid-lobe of the lip and the callus on the mid-lobe is higher at its proximal part and not so completely split in two lateral halves by a longitudinal furrow...the side-lobes are longer with quite rounded obtuse apex'. We have examined the type material of both species and specimens from across the distribution range. Although there is some variability in the shape of the lip lateral lobes and callus, the variation appears to be continuous and we therefore treat them as conspecific.

Section **Pilearia** (Lindl.) Seidenfaden in Dansk Bot. Ark. 29(3): 55 (1975).

8. C. filiforme (Lindl.) Garay in Bot. Mus. Leafl. 23(4): 171 (1972). Type: India, *Fielding* s.n. (holo. K-LINDL!).

Sarcanthus filiformis Lindl. in Bot. Reg. 28 : misc.61, no.69 (1842).

Plant pendent; roots arising from nodes, slender, grey. *Stem* covered by leaf sheaths, 1–3.5mm wide; sheaths tubular, 3–3.5cm long. *Leaves* terete, rugose, apex subacute, sessile, 19–26 × 0.2cm. *Inflorescence* lateral, axillary, leaf-opposed, racemose, laxly 19- to 28-flowered; peduncle glabrous, sheathed, 3cm long; sheaths tubular, 2–3mm long; rachis glabrous, 12cm long; floral bracts triangular, 1–1.2 × 0.8–1mm (at base). *Flowers* 6–7mm across; sepals and petals deep purple with a central yellow stripe, lip white, epichile pale mauve, column yellowish; peduncle and ovary glabrous, 5–7mm long. *Dorsal sepal* hooded, ovate, obtuse, 2–3 × 0.8–1mm; *lateral sepals* spreading, ovate-elliptic, subacute, weakly falcate, 3-veined, 3.7–4.1 × 1–1.8mm. *Petals* spreading, narrowly oblong-lanceolate, acute, 1-veined, 2.5–3 × 0.6–0.8mm. *Lip* 3-lobed, spurred, 3.5–5mm long; hypochile saccate-spurred, lateral lobes broadly rounded to obscurely 2-lobed, 0.7–0.9mm tall; epichile deflexed, ovate-lanceolate, apex acute to subacute, with 2 basal triangular projections, 2–3.5mm long; back wall callus broadly rhombic to pentagonal, c.1mm long, with a small vertical median keel and 2 small pubescent bumps at either side; spur cylindric, base broad, 2.5 × 2.5mm. *Column* 1–1.5 × 0.8–1mm (at base); pollinia 0.2mm across; stipe simple, 0.4mm long.

Darjeeling (unlocalised *Griffith* specimen); **Sikkim** (5km SW of Gangtok, near Raniphul). On *Ficus* sp., in tropical valleys; 1500m. Fl. July–August.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China, Thailand and Vietnam.
ETYMOLOGY. From the Latin *filiformis* (thread-like) in reference to the leaves.

Section **Complicatum** Seidenfaden in Dansk Bot. Ark. 29(3): 63 (1975).

9. **C. simondii** (Gagnepain) Seidenfaden in Dansk Bot. Ark. 29(3): 66 (1975). Type: Vietnam, Upper Tonkin, Rives fide icon. Simond 56 (holo. P).

Vanda simondii Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 22: 628 (1950).

Sarcanthus appendiculatus sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 240, t.318 (1898), *non* (Lindl.) Bentham & Hook. f.

Echioglossum simondii (Gagnepain) Szlachetko, *loc. cit.* (1995).

Plant erect; *roots* arising from nodes, branched, 15–30cm long. *Stem* erect, covered by persistent leaf sheaths, 3–4mm thick; sheaths overlapping, 1.5–1.8cm long. *Leaves* terete, fleshy, linear, apex subacute to obtuse, sessile, jointed, 5.5–8.5 × 0.1–0.2cm. *Inflorescence* extra-axillary, pendent, long, simple or paniculate, laxly 11- to 20-flowered; peduncle slender, sheathed, 5–12cm long; sheaths basal and inserted at intervals of 2–2.5cm, tubular, cylindric, ovate, apex triangular, 2.3mm long, rachis glabrous, 5–16cm long; floral bracts lanceolate, subacute, 1–2 × 0.1–0.15mm. *Flowers* 7–9mm across; sepals and petals yellow to buff-coloured with many longitudinal purple to brown-purple markings, lip mid-lobe mauve to pink; pedicel and ovary glabrous, 6–9mm long. *Dorsal sepal* broadly oblong, rounded, 3-veined, 4–5 × 1–2mm; *lateral sepals* oblong, obtuse, 5–6 × 1–2mm. *Petals* narrowly oblong, acute, 4–6 × 0.5–1mm. Lip jointed to the column foot, spurred, 3-lobed, 5–6mm long; lateral lobes narrowed suddenly to a conical point, base broad; mid-lobe fleshy, broadly triangular, decurved, apex narrowed to apiculate; *spur* basal, funnel shaped, apex obtuse, globose, with a large callus on front and back walls, 5–6 × 2–2.5mm. *Column* 1.5–2mm long; foot thick; anther cap with a short, erose appendage, c.1.5mm long. *Fruit* fusiform, ridged, shortly stalked, 2.5–3 × 0.4–0.6cm.

14 **Sikkim** (unlocalised Pantling specimens). 100–1000m. Fl. August–October.

GENERAL DISTRIBUTION. NE India, China, Thailand, Laos and Vietnam.
ETYMOLOGY. Named after a Mr Simond who collected for Gagnepain.
NOTE. Seidenfaden (1975b) included *Sarcanthus appendiculatus sensu* King & Pantling within the synonymy of *C. simondii* and we follow him here.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

C. tricallosum Hegde & A.N. Rao in Orchid. Rev. 91(1072): 54 (1983). Types: India, Arunachal Pradesh, West Kameng district, Sessa, *Hegde* 4127 (holo. Orchid Herbarium Tipi).

NOTES. This species was described by Hegde & Rao (1983a) from Sessa in the W Kameng district of Arunachal Pradesh. It is the only species in section *Cleisostoma* from our area that lacks a septum within the spur and is related to *C. kerrii* Seidenfaden and *C. aspersum* (Rchb. f.) Garay.

111. **Diploprora** Hook. f.

Plants epiphytic, pendent. *Leaves* distichous. *Inflorescence* lateral, racemose, laxly few-flowered. *Flowers* non-resupinate, appearing a few at a time. *Sepals* and *petals* similar, spreading; sepals keeled on back. *Lip* spurless, fleshy, immobile, broadly attached to column base; hypochile boat-shaped, with raised side lobes; epichile narrowed, long drawn-out, apex ± forked into 2 tails, or truncate. *Column* lacking a foot, short, stout; stigma large; pollinia 4 (unequal), globose; stipes narrowed from a broad base; viscidium ovate.

The genus *Diploprora* was established in 1890 by Hooker in his *Flora of British India* and emended in 1892 in his *Icones Plantarum*. The genus comprises two species distributed from Sri Lanka and N India, Myanmar, China, Thailand to Taiwan.

TYPE. *Diploprora championii* (Lindl. ex Bentham) Hook. f.; basionym: *Cottonia championii* Lindl. ex Bentham.
ETYMOLOGY. From the Greek *diplo-* (double) and *prora* (prow) in reference to the spreading bifurcation of the lip apex.

1. **D. championii** (Lindl. ex Bentham) Hook. f., Fl. Brit. India 6(1): 26 (1890); Icon. Pl. 22: t.2120 (1894).
Type: China, Hong Kong, Victoria Peak, *Champion* 277 (holo. K-LINDL!, iso. K!).
Cottonia championii Lindl. ex Bentham in Hooker's J. Bot. Kew Gard. Misc. 7: 35 (1855).
Sarcanthus rostratus Seeman, Bot. Voy. Herald: 419 (1857).
Luisia bicaudata Thwaites, Enum. Pl. Zeyl.: 302 (1861). Type from Sri Lanka.
Vanda bicaudata (Thwaites) Thwaites, *op. cit.* 429 (1865).
Diploprora kusukusensis Hayata, Icon. Pl. Formos. 4: 86, f.42 (1914). Type from Taiwan.
D. uraiensis Hayata, *op. cit.* 87, f.43 (1914). Type from Taiwan.
D. bicaudata (Thwaites) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 281 (1919).
Stauropsis championii (Lindl.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 93 (1951).
S. kusukusensis (Hayata) T. Tang & F.T. Wang, *loc. cit.* (1951).

Plant 11.5cm tall; *roots* piercing through leaf sheaths, grey, 11–13cm long. *Stem* covered by leaf sheaths; internodes 0.6–1.1cm long. *Leaves* oblong-lanceolate to ovate-elliptic, apex acute to apiculate, sessile, jointed, 4–9.5 × 0.8–2cm. *Inflorescence* laxly 4- to 8-flowered; peduncle sheathed at base, glabrous, 1.5–2.8cm long; sheath 5mm long; rachis winged, weakly zigzag, glabrous, 3.5cm long; floral bracts ovate, acute, 2.5–5mm long. *Flowers* 1cm across; sepals and petals yellow, lip pale yellow to white with pink-purple markings; pedicel and ovary becoming elongate-cuneate after pollination, 4–5mm long. *Dorsal sepal* ovate-elliptic, subacute to acute, 3-veined, spreading, 6–7 × 2–3mm; *lateral sepals* ovate, acute, 3-veined, 6–9 × 2.5–3mm. *Petals* spreading, lanceolate-elliptic, acute, 3-veined, 5–7 × 1.5–2mm. *Lip* adnate to base and sides of column, sigmoidally curved, 5–8 × 3–4mm; hypochile erect, boat-shaped, edges recurved; epichile broadly triangular at base, narrowed abruptly to a 2-caudate apex; disc with an erect keel. *Column* broad, porrect, lacking a foot, 2mm long; anther conical, 1–1.5mm across; stipe broad-based. *Fruit* cylindric-fusiform, 3–5 × 0.5–0.7cm. **Fig. 114.**

Sikkim (above Engo?). 660–1330m. Fl. July–August.

GENERAL DISTRIBUTION. Sri Lanka, India, Myanmar, China, Thailand, Vietnam and Taiwan.
ETYMOLOGY. Named after John George Champion (1815–1854), a Lieutenant-Colonel in the 95th Regiment in Hong Kong between 1847 and 1850 who sent the type specimen to Kew.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

D. truncata Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 385 (1925). Type: Thailand, Doi Sutep, *Kerr* 270 (holo. K!).
Stauropsis truncata (Rolfe ex Downie) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1–2): 94 (1951).

NOTE. This species was reported by Rao (1996b) from Tipi in the W Kameng district of Arunachal Pradesh. It had previously been reported only from Thailand.

112. **Esmeralda** Rchb. f.

Plants epiphytic, large, erect; *roots* aerial, piercing through leaf sheaths along the stem. *Stem* stout, terete, scandent. *Leaves* coriaceous, distichous, apex unequally 2-lobed, base sheathing, twisted (to lie in one plane), jointed. *Inflorescence* lateral, racemose, erect, few-flowered; floral bracts persistent,

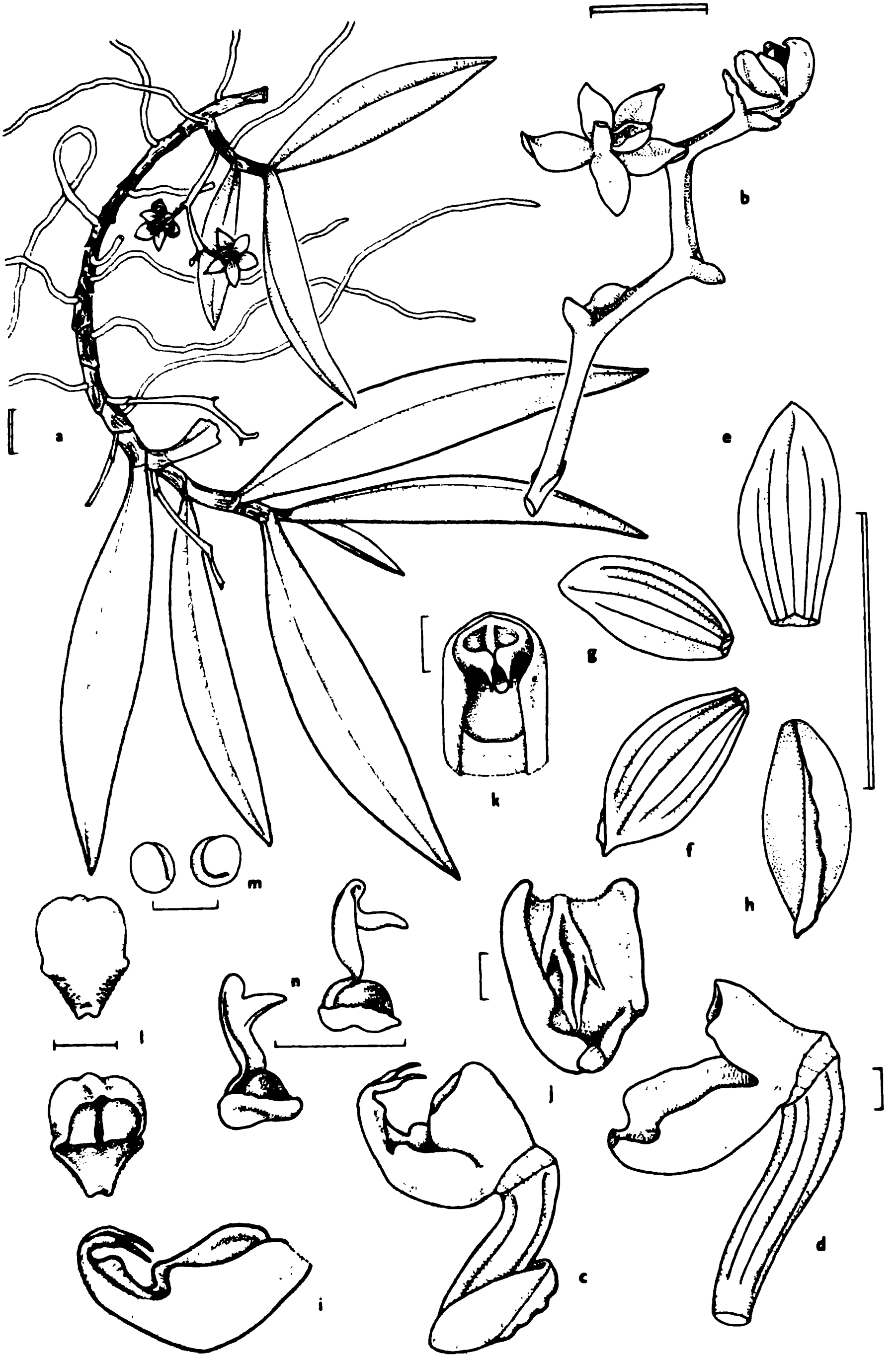

Fig. 114. **Diploprora championii**: a, habit; b, inflorescence; c, lip, column and ovary (with bract); d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, lip (side view); j, lip (unfolded); k, column apex; l, anther (two views). m, pollinia; n, stipe and viscidium (two views). Drawn by Susanna Stuart-Smith from *Hooker* s.n. (K).

scarious, sheathing. *Flowers* showy. *Sepals* and *petals* similar, spreading, overlapping, ovate to oblong. *Lip* free, 3-lobed, pendent, mobile; lateral lobes small; mid-lobe clawed, reniform, margin crenate; disc 2-callose. *Column* short, stout; anther terminal; pollinia 4, in 2 pairs, dorsally compressed.

The genus *Esmeralda* was established in 1874 by H.G. Reichenbach in his *Xenia Orchidaceae*. The genus comprises two species occuring in the Himalaya, Myanmar, S China and Thailand.

Tan (1975, 1976) reviewed the taxonomic position of *Esmeralda* and related genera. The lip is mobile and can be set into motion by a light breeze.

TYPE. *Esmeralda cathcartii* (Lindl.) Rchb. f.; basionym: *Vanda cathcartii* Lindl.
ETYMOLOGY. From the Greek *smaragdus* (emerald green) possibly a reference to the jewel-like beauty of this orchid or, perhaps, to the deep green colour of the leaves.

Key to species

1. Sepals broadly oblong-elliptic; sepals and petals white; flowering March to July **1. E. cathcartii**
+ Sepals narrowly oblong; sepals and petals yellow; flowering October to November **2. E. clarkei**

1. E. cathcartii (Lindl.) Rchb. f., Xenia. Orchid. 2: 39 (1874). Types: India, Sikkim, *Hooker* 175 (syn. K-LINDL!); Sikkim, icon. Cathcart 175 (syn. K-LINDL!, isosyn. K!).
Vanda cathcartii Lindl., Fol. Orchid. Vanda 4: 8, no.17 (1853).
Arachnanthe cathcartii (Lindl.) Bentham & Hook. f., Gen. Pl. 3: 573 (1883).
Arachnis cathcartii (Lindl.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72:75 (1912).

Plant pendent, large; *roots* 5–7mm wide. *Stem* covered by leaf sheaths, 4–6mm wide; sheaths tubular, 2.8–6cm long. *Leaves* narrowly to broadly oblong-elliptic, apex unequally 2-lobed, lobules broad, obtuse, slightly narrowed (but sessile) at base, jointed, 9–24 × 0.9–5cm. *Inflorescence* 3- to 6-flowered; peduncle glabrous, sheathed at base, 3.5–9cm long; sheaths 1–3, overlapping, tubular, 0.2–1.2cm long; rachis glabrous, 9–14cm long; floral bracts broadly oblong, obtuse, 0.9–1.2 × 0.6–0.8cm. *Flowers* fleshy, 6–9cm across; sepals and petals white externally, internally chocolate-brown, finely striped with yellow, lip white externally, internally white with yellow lateral lobes and apex, and pink markings; pedicel and ovary glabrous, 2.5–3.2cm long. *Dorsal sepal* elliptic, obtuse, narrowed at base, 3.4–4.5 × 1.9–2.4cm; *lateral sepals* oblong-elliptic, weakly falcate, obtuse, narrowed at base, 3.2–4 × 1.6–2.3cm. *Petals* elliptic, obtuse, narrowed at base, 2.9–3.6 × 2.1–2.6cm. *Lip* clawed at base, oblong, broadly 4-lobed, 1.7cm long; hypochile transversely oblong, with upturned lateral lobes, 0.9–1.1cm across; epichile broadly ovate, obtuse, fleshy, margins upturned to form a saccate area; disc 3- to 5-ridged, with a horizontal funnel shaped cavity from base to near apex. *Column* stout, expanded at base, 1.6–2 × 0.6–0.8cm; anther cap conical, 2–3mm across. *Fruit* cylindric-fusiform, tapering to stalked base, 8–11 × 1.8–2.8cm; stalk 1.5–2cm long. **Fig. 115; Plate 28.**

Bhutan: S – Gaylegphug district (Gaylegphug, Rang Khola); **Darjeeling** (Dumsong, Labah); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). In large clusters on trees in tropical broad-leaved forest, by streams in deep cool shade; 660–2000m. Fl. March–July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after John Cathcart (1802–1851) who collected plants in Darjeeling and engaged Indian artists to draw them.

2. E. clarkei Rchb. f. in Gard. Chron. n.s. 26: 552 (1886). Type: Indian Himalayas, *Clarke* s.n., cult. Low (holo. W! Herb. no. 3921, 3922).
Vanda clarkei (Rchb. f.) N.E. Brown in Bull. Misc. Inform. Kew 1888: 112 (1888).
Arachnanthe clarkei (Rchb. f.) Rolfe in Gard. Chron. ser.3, 4: 567 (1888).
Arachnis clarkei (Rchb. f.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 73 (1912).

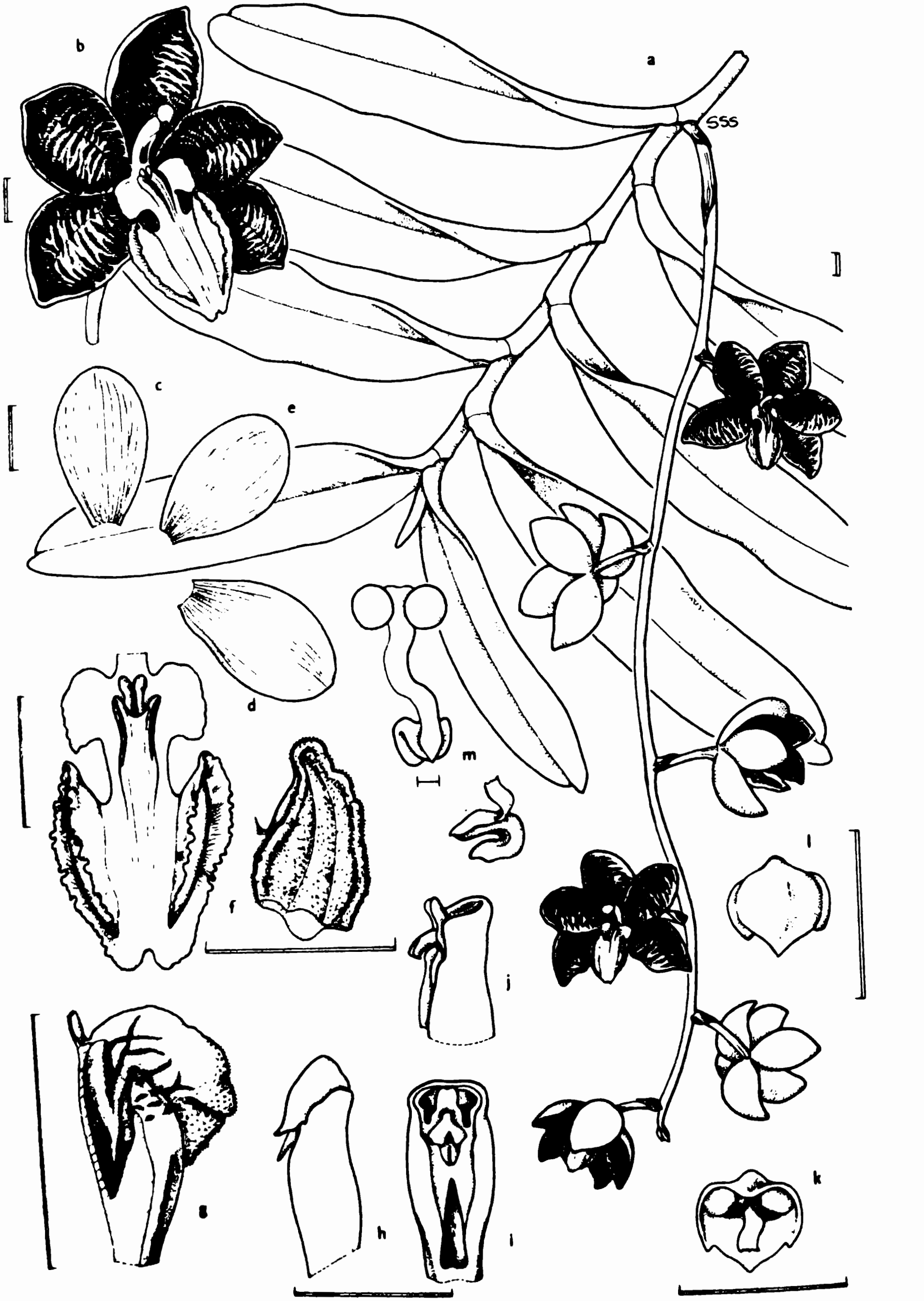

Fig 115 **Esmeralda cathcartii** a, habit; b, flower; c, dorsal sepal; d, lateral sepal; e, petal; f, lip (with surface detail); g lip (sectioned), h, column (side view), i, column with anther removed (front view); j, column with anther removed (side view), k anther (front view); l, anther (back view); m, pollinarium (with detail of viscidium). Drawn by Susanna Stuart-Smith. a–b h–m from *Pantling* 111 (K); c–g from *Griffith* 5393 (K).

Plant to 1m tall. *Stem* covered by leaf sheaths; sheaths tubular, 3–4cm long. *Leaves* coriaceous, oblong, apex unequally 2-lobed, margins undulate, jointed, 15–23 × 2.2–3.5cm. *Inflorescence* erect, 3- or 4-flowered; peduncle glabrous, sheathed at base, 3–5cm long; rachis weakly zigzag, glabrous, 12–15cm long; floral bracts broadly ovate, 1.2–1.6cm long. *Flowers* slightly fragrant, 5.5–7.5cm across; sepals and petals yellow, transversely streaked with chestnut-brown or red, lip epichile brown-red with 7–9 radiating white keels, column yellow, spotted with brown; pedicel and ovary slender, glabrous, 3–4cm long. *Dorsal sepal* erect, oblong, obtuse, 3.3–3.9 × 0.9–1cm; *lateral sepals* falcate, oblong, base cuneate, 3–3.2 × 0.9–1.2cm. *Petals* falcate, oblong to subspathulate, obtuse, 2.9–3.5 × 0.7–0.8cm. *Lip* free, pendent, 3-lobed, c.1.7cm long; hypochile with 2 auriculate lateral lobes, 6–8 × 5–6mm; mesochile narrow, 4–5 × 1–1.5mm; epichile reniform, margins crenulate, 8–9 × 5–6mm; disc with 7–9 radiating keels and 2 raised calluses in centre of lip. *Column* stout, clavate, 0.9–1cm long; pollinia 1.5mm across; stipes horseshoe-shaped, 4 × 2mm. *Fruit* cylindric, stalked, 6.5 × 1.7cm; stalk 2cm long.

Bhutan: C – Tashigang district (Tashigang (M.F.B.), near Tashi Yangtsi (M.F.B.)); **Darjeeling** (Dumsong, Santuk); **Sikkim** (Yoksam). 2000m. Fl. October–December.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar and China (Yunnan).

ETYMOLOGY. Named after Charles Baron Clarke (1832–1906) who was Superintendent of the Calcutta Botanic Garden from 1867 to 1871 and collected the type specimen.

113. Gastrochilus D. Don

Plants epiphytic, with short to long monopodial stems. *Leaves* coriaceous, distichous. *Inflorescence* axillary, short, few-flowered; peduncle short; rachis short. *Flowers* fleshy, conspicuous. *Sepals* and *petals* similar, spreading. *Lip* adnate to column base; hypochile globose, saccate, sides adnate to the column wings; epichile broad, rounded, flat, sometimes pubescent to fimbriate. *Column* very short, stout, lacking a foot; pollinia 2, grooved; stipe long.

The genus *Gastrochilus* was established in 1825 by David Don in his *Prodromus Florae Nepalensis*. The genus comprises about 20 species distributed in India, Nepal, SE Asia, Malaysia and the adjacent islands.

Christenson (1985b, 1987a) provided a short synopsis and index of the genus; Seidenfaden (1988) reviewed the Thai species, and Tsi (1996) those from China.

TYPE. *Gastrochilus calceolaris* (Buchanan-Hamilton ex J.E. Smith) D. Don; basionym: *Aerides calceolaris* Buchanan-Hamilton ex J.E. Smith.

ETYMOLOGY. From the Greek *gastro-* (belly) and *cheilos* (lip), an allusion to the swollen lip.

Key to species

1. Leaves terete .... **4. G. inconspicuus**
+ Leaves flattened 2

2. Stem more than 4mm across; leaves more than 4.5cm long and 1cm wide 3
+ Stem less than 3mm across; leaves less than 4cm long and 1cm wide 7

3. Upper surface of epichile papillose 4
+ Upper surface of epichile smooth 5

4. Stem elongate; leaves acute .... **1. G. acutifolius**
+ Stem reduced; leaves unequally 2-lobed .... **2. G. calceolaris**

5. Stem elongate; ridge of hypochile raised above the epichile .... **5. G. linearifolius**
+ Stem reduced; ridge of hypochile not raised above the epichile 6

6. Sepals and petals bright red .... **3. G. dasypogon**
+ Sepals and petals bright yellow with brownish-purple spots .... **6. G. obliquus**

7. Epichile of lip ecallose; flowering August to October 8
+ Epichile of lip with calluses or ridges; flowering March to July 9

8. Epichile of lip rhombic; sepals and petals more than 6mm long .... **8. G. corymbosus**
+ Epichile of lip cordate, ecallose; sepals and petals less than 4mm long **10. G. pseudodistichus**

9. Lip apical lobe with 2 median ridges; lip margin erose; flowering June to July .... **7. G. affinis**
+ Lip apical lobe with 2 small, conical calluses; lip margin entire; flowering March to May
9. G. distichus

Section **Gastrochilus**

1. G. **acutifolius** (Lindl.) Kuntze, Revis. Gen. Pl. 2: 661 (1891). Type: India, icon. Wallich 1137 (holo. K!).
Aerides umbellatum Wall. in Lindl., Gen. Sp. Orchid. Pl.: 223 (1833), nom. nud.
Saccolabium acutifolium Lindl., Gen. Sp. Orchid. Pl.: 223 (1833).
S. denticulatum Paxton in Paxton's Mag. Bot. 7: 145 + fig. (1840). Type: India, Khasia, Gibson, cult. Chatsworth (holo. [icon. in] Paxton's Mag. Bot. 7: 145 + fig. (1840)!)
S. dentatum Rchb. f. in Walpers, Ann. Bot. Syst. 6: 883 (1864), sphalm.

Plant 14–18cm tall; roots pendent. Stem slender, erect, weakly zigzag, covered by leaf sheaths, 10–30 × 0.5cm; sheaths overlapping, 1.4–1.6cm long. *Leaves* distichous, linear-lanceolate to oblong-lanceolate, coriaceous, acute to acuminate, jointed, 8–15 × 1.7–4cm. *Inflorescence* corymbose, densely many-flowered; peduncle sheathed, 1.1–4cm long; sheaths 2 or 3, tubular at base, distant above, 3–4mm long; floral bracts broadly oblong, obtuse, 1.5–2 × 1–1.5mm. *Flowers* fleshy, 1.5–2cm across; sepals and petals orange-yellow, yellowish-red to yellowish-green, spotted or mottled with brown, lip white with a yellow centre, speckled with red, column stained with pale purple; pedicel and ovary slender, 1.5–1.7cm long. *Sepals* similar, obovate-oblong, obtuse, 4–8 × 1.5–2mm. *Petals* narrowly obovate-oblong, obtuse, 4–8 × 1.5–3.5mm. *Lip* subglobose to hemispheric, 4–6 × 4–8mm (at apex when spread); hypochile saccate; lateral lobes narrow, obscure; epichile triangular-reniform, broadly 3-lobed, margins fimbriate with glandular hairs; disc naked to sparsely tuberculate. *Column* 0.7–1.5mm long. *Fruit* cylindric to ovoid, ridged, 4–6 × 0.7–0.9cm. **Plate 28.**

Bhutan: S – Gaylegphug district (Rani Camp (M.F.B.)); C – Punakha district (Talo); **Darjeeling** (unlocalised *Griffith* specimen); **Sikkim** (Engo?). 1000–2000m. Fl. (August–)November–December; Fr. August.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Latin *acutus* (sharp-pointed) and *-folius* (leaved).
NOTE. The type drawing cited by Lindley has flowers with pale yellow sepals and petals lacking blotching or spotting.

2. G. **calceolaris** (Buchanan-Hamilton ex J.E. Smith) D. Don, Prodr. Fl. Nepal.: 32 (1825). Type: Nepal, Narainhetty, Buchanan-Hamilton s.n. (holo. LINN! Herb. no. 1404.29, iso. BM!).
Aerides calceolaris Buchanan-Hamilton ex J.E. Smith in Rees, Cycl.(Addenda): 39: Aerides, no.11 (1819).
Epidendrum calceolare Buchanan-Hamilton in D. Don, Prodr. Fl. Nepal.: 32 (1825), nom. nud.
Sarcochilus nepalensis Sprengel, Syst. Veg. ed.16(3): 721 (1826), nom. alt.

Saccolabium calceolare (Buchanan-Hamilton ex J.E. Smith) Lindl., Gen. Sp. Orchid. Pl.: 223 (1833).
Aerides leopardinum Wall. ex Lindl., Sert. Orchid. (frontispiece): 6 (1838), *nom. nud.*
A. leopardorum Wall., in Hook. f., Fl. Brit. India 6(1): 60 (1890), nom. nud.

Plant pendent, 15–22cm tall; *roots* ridged, 2–3mm thick. *Stem* sheathed, 5–8 × 0.5–0.8cm; sheaths tubular, pouch-like, acute, overlapping, 1.2–1.8cm long. *Leaves* distichous, strongly falcate, linear-lanceolate to oblong-lanceolate, apex acutely, unequally emarginate, 6–28 × 0.8–2.5cm. *Inflorescence* short, corymbose to subracemose, much shorter than the leaves, pendent, subdensely 7- to 9-flowered; peduncle glabrous, sheathed, 2.5–3cm long; sheaths distant, ovate, 2–3mm long; floral bracts ovate, acute, 2.5–3.5mm long. *Flowers* fragrant, 0.8–1.8cm across; sepals and petals yellow to greenish, speckled, barred or blotched with red-brown, lip white or yellow, speckled with red; pedicel and ovary glabrous, 1–1.4cm long. *Sepals* similar, narrowly elliptic, subacute to rounded, 6–8 × 3–3.5mm. *Petals* subspathulate, obtuse, 6–7 × 2–3mm. *Lip* sessile, 7–8 × 5–6mm; hypochile saccate-globose, c.4mm deep; epichile reniform, margin denticulate; disc heavily echinate. *Column* fleshy, 1.5–2.5mm tall; anther cap c.2.5mm across; stipe c.2mm long; pollinia c.0.5mm across. *Fruit* narrowly ovoid, 3.5–4.5 × 0.7–1.2cm.

Bhutan: S – Samchi (Changda Chungli Hill (M.F.B.)), Chukka (Chaisilakha (M.F.B.)) and Gaylegphug (Betini, Gaylegphug) districts; **C** – Punakha district (Tashi Choling, Tinlegang); **N** – Upper Kulong Chu district (Tobrang (M.F.B.)); **Darjeeling** (Puttabong, Takdah); **Sikkim** (Chiya Bhanjang to Dentam, Namchi, Penlang La, Yoksam). In hot valleys; (270–)1500–2000m. Fl. March–May.

GENERAL DISTRIBUTION. India (Himalayas), Nepal, Myanmar, China, Thailand, Vietnam to Malaysia (Perak).
ETYMOLOGY. From the Latin *calceolatus* (slipper-shaped) in reference to the the lip.

3. **G. dasypogon** (J.E. Smith) Kuntze, Revis. Gen. Pl.: 661 (1891). Type: Nepal, icon. Buchanan-Hamilton (holo. LINN!, iso. British Library (India Office)!).
Aerides dasypogon J.E. Smith in Rees, Cycl.(Addenda) 39: Aerides, no.10 (1819).
Saccolabium dasypogon (J.E. Smith) Lindl., Gen. Sp. Orchid. Pl.: 222 (1833).

Plants to 25cm tall; *roots* densely clustered below, white. *Stem* 1–3cm long. *Leaves* alternate, broadly ovate, fleshy, smooth above, minutely scaly beneath, apex acute, unequally 3-toothed, margins revolute, base sheathing, c.7.5cm long. *Inflorescence* corymbose to umbellate, c.4cm long, densely many-flowered; floral bracts ovate, hooded, c.5mm long. *Flowers* c.2.5cm across; sepals and petals deep red inside and green outside, spotted with violet, lip white or yellow spotted with blood-red to purple. *Sepals* similar, obovate to spathulate, concave, obtuse, c.8 × 2mm. *Petals* obovate, obtuse, c.8 × 2mm. *Lip* keeled, globose, epichile broadly spreading-reniform, margins erose. *Column* short. *Fruit* c.7.5cm long.

Bhutan/Sikkim (unlocalised (Seidenfaden, 1987)); **Darjeeling** (unlocalised *Cowan* specimen).

GENERAL DISTRIBUTION. Nepal (?extinct), NE India.
ETYMOLOGY. From the Greek *dasy-* (thick-haired) and *pogon* (beard).
NOTE. Seidenfaden (1987) discussed the history of this species and reported the acquisition by N. Trudel of a specimen (with its unmistakable red flowers) from a dealer in Kalimpong which probably came from Sikkim or Bhutan.

4. **G. inconspicuus** (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 661 (1891). Type: India, Lower Assam, icon. Jenkins (holo. CAL, iso. K!).
Saccolabium inconspicuum Hook. f., Fl. Brit. India 6(1): 56 (1890).
Luisia micrantha Hook. f., *op. cit.* 23 (1890). Types: India, Assam, *Griffith* 5186 (syn. K!); Khasia, *Mann* 12 (syn. K!).
Cymbidium inconspicuum Wall. ex Hook. f., Fl. Brit. India 6(1): 56 (1890); Ann. Roy. Bot. Gard. (Calcutta) 5(1): 46 (1895), nom. nud.

Luisia inconspicua (Hook. f.) Hook. f. ex King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 203, t.272 (1898).

Plant to 30cm tall; *roots* basal. *Stem* terete, flexuous, unbranched or occasionally branched, covered by leaf sheaths, red-brown, 3.5–15cm long; sheaths overlapping, striate-rugose, 0.7–1.1cm long. *Leaves* terete, straight to weakly curved, rugose-striate, dark green, sessile, 2.8–8.5 × 0.1–0.2cm. *Inflorescence* lateral, racemose, 1- to 4-flowered; peduncle short, sheathed; rachis 1–2mm long; floral bracts triangular, acuminate, membranous, 0.5–2 × 0.3–1mm. *Flowers* 4mm across; sepals and petals greenish-white, lip pale greenish-white with lateral lobes suffused with purple, column purple with green inside, pollinia bright yellow; pedicel and ovary curved, 3–4mm long. *Dorsal sepal* ovate to ovate-lanceolate, suboblique, acute, 1-veined, recurved, spreading, 1.5–3 × 1–1.3mm; *lateral sepals* similar. *Petals* oblong to ovate-elliptic, acute, spreading, 2–3 × 1–1.2mm. *Lip* 3-lobed, 2–3 × 1.5–2mm; hypochile hemispherically saccate, lateral lobes rounded; mid-lobe flat, decurved, weakly cordate to reniform, surface mintely hispid with 6- to 7-striae, apex 2-lobed, lobules rounded; sac 1–1.6mm across. *Column* erect, lacking a foot, c.0.5mm long; anther cap shortly beaked; viscidium subquadrate; pollinia 0.3–0.4mm across. *Fruit* clustered, ovoid, ridged, 6–9 × 1.8–2.2mm. **Fig. 116; Plate 29.**

Bhutan: S – Sarbhang (Kami Khola) and Gaylegphug (Gaylegphug (M.F.B.)) districts; **Darjeeling** (between Sivok and Bara Mangwa); **Sikkim** (Temi). Epiphytic in monsoon forest; 200–660m. Fl. June–July.

GENERAL DISTRIBUTION. Nepal, NW and NE India.
ETYMOLOGY. From the Latin *inconspicuus* (small) probably in reference to the flowers.
NOTES. This species has features of both *Gastrochilus* and *Luisia*. It has a saccate hypochile (a feature of *Gastrochilus*) but terete leaves, which is not usually a feature of the genus. Tsi (1996) treated it under *Luisia*, but following the key characters given in Seidenfaden (1988) and referring to his herbarium notes we follow him and retain it within *Gastrochilus*.

22 5. **G. linearifolius** Z.H. Tsi & Garay in Guihaia 16(2): 138 (1996). Type: India, Sikkim, *Pantling* 356 (holo. CAL, iso. AMES BM! K! W!).

Gastrochilus intermedius sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 226, t.301 (1898), *non* (Griff. ex Lindl.) Kuntze.

Plant to 26cm tall; *roots* arising from nodes. *Stem* covered by leaf sheaths, c.26 × 0.5cm; internodes 1.5–2cm long. *Leaves* linear to narrowly falcate, acuminate, with 3 needle-like points at apex, jointed, sessile, 8–13.5 × 0.5–1cm. *Inflorescences* umbellate, many up stem, 3- or 4-flowered; peduncle sheathed, 0.8–1cm long; sheaths semi-circular, distant, 1–1.5mm long; floral bracts lanceolate, 1–1.5mm long. *Flowers* fleshy, 0.8–1cm across, yellow spotted with brownish-purple, lip fimbriae white, column pinkish; pedicel and ovary slender, 0.8–1.1cm long. *Dorsal sepal* spreading, oblong-oblanceolate, obtuse, 4.5–5 × 2–2.5mm; *lateral sepals* narrowly oblong-oblanceolate, subacute, 4–5 × 1–2mm. *Petals* oblong to ± oblanceolate, obtuse, 3–4 × 1–2mm. *Lip* fleshy, adnate to the column base, deeply saccate to base, obscurely 3-lobed; base c.3.5 × 2.5mm; lateral lobes obscure, vertically ridged, raised above the mid-lobe; mid-lobe semi-circular from a broad base, minutely papillose, apex obtuse, margins densely irregularly fimbriate, c.2.2 × 4mm; disc with papillose cushion on mid-lobe; sac 2–2.5mm deep. *Column* stout, c.1mm long; anther cap shortly beaked.

Sikkim (unlocalised *Pantling* specimen). 1600m. Fl. August.

GENERAL DISTRIBUTION. NE India and China.
ETYMOLOGY. From the Latin *linearis* (narrow) and *-folius* (leaved).
NOTES. Material of this species from Sikkim was referred to *G. intermedius* by King & Pantling (1898). Tsi (1996), however, realised that the Pantling collection belonged to a distinct species easily distinguished by the densely fimbriate margins on its lip mid-lobe. *G. intermedius* occurs in Khasia and has not yet been recorded from Sikkim or Bhutan.

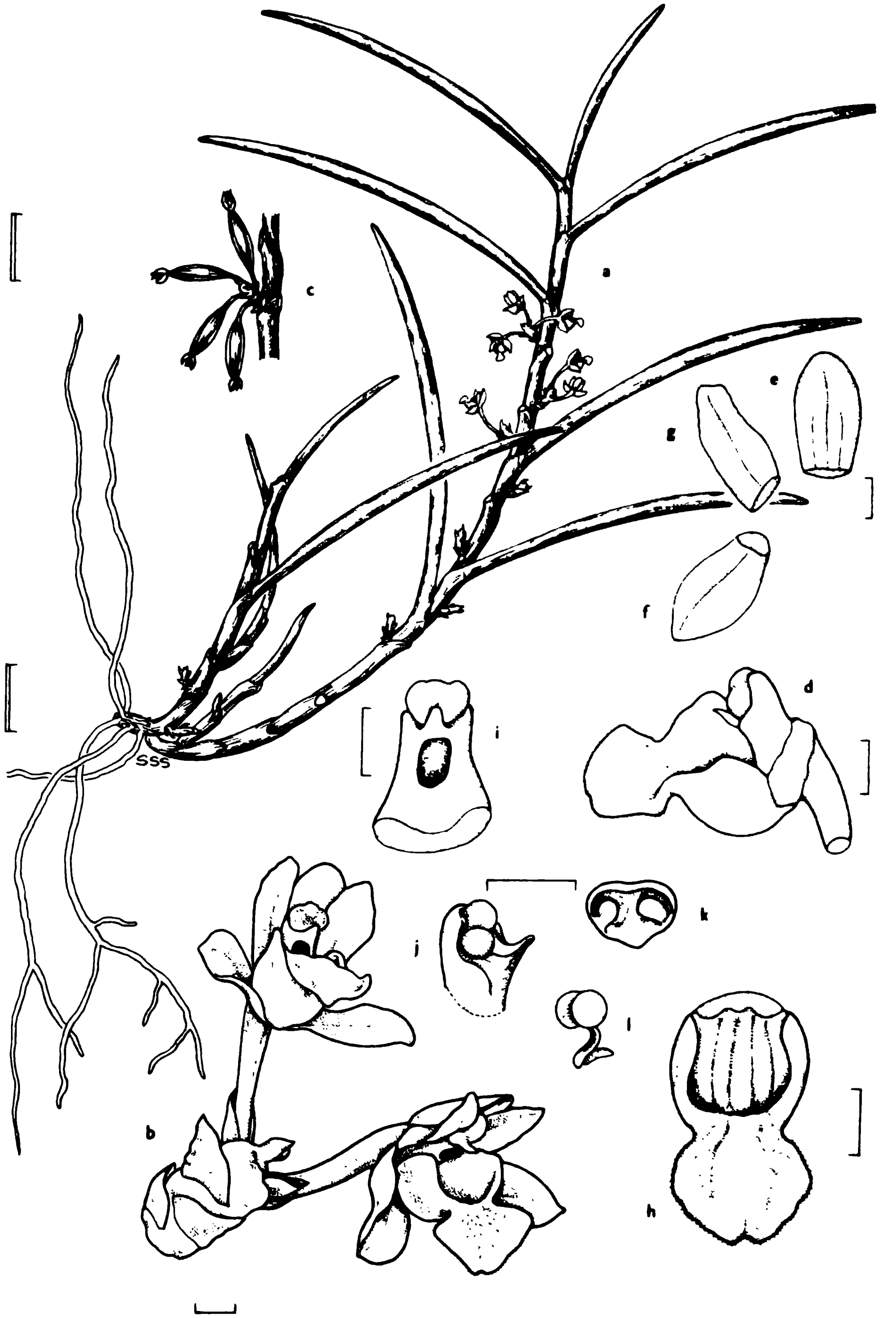

Fig. 116. **Gastrochilus inconspicuus**: a, habit; b, inflorescence; c, infructescence; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column apex; j, column apex (side view); k, anther; l, pollinarium. Drawn by Susanna Stuart-Smith, a–b from Herb. Genavense 847028 (K); c–l from *Grierson & Long* 3642 (E).

6. **G. obliquus** (Lindl.) Kuntze, Revis. Gen. Pl. 2: 661 (1891). Type: Myanmar (Burma), Taong Dong, coll. *Wallich* Wall. Cat. 7304 (holo. K-LINDL!, iso. K-W!).

Saccolabium obliquum Lindl., Gen. Sp. Orchid. Pl.: 223 (1833).

S. bigibbum Rchb. f. ex Hook. f. in Bot. Mag. 95: t.5767 (1967), **syn. nov.** Type: Myanmar (Burma), Arrakan, cult. Veitch (holo. W! no.42844).

Gastrochilus bigibbus (Rchb. f. ex Hook. f.) Kuntze, Revis.Gen. Pl. 2: 661 (1891), **syn.nov.**

Saccolabium dasypogon sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 225, t.299(1898), *non* (J.E. Smith) Kuntze.

var. **obliquus**

Plant pendent; *roots* clustered. *Stem* pendent. covered with overlapping leaf sheaths, 1.5–2cm long. *Leaves* weakly flabellate, oblong. acute, minutely, unequally 2-lobed, sessile, jointed, 5–17 × 1.9–2.9cm. *Inflorescence* corymbose, dense; peduncle stout, sheathed, 1–1.5cm long; sheaths tubular at base, 5–6mm long; floral bracts broad, obtuse. 5–6 × 2.5–3mm. *Flowers* 0.9–1.6cm across; sepals and petals bright yellow with brownish-purple spots, lip white with a patch of yellow with brown spots at apex, and a purple line around edges of the sac, column pink; pedicel and ovary slender, 0.8–1.3cm long. *Sepals* spreading, oblong-oblanceolate to spathulate, obtuse, 6–9 × 2–4mm; *lateral sepals* oblong, obtuse, 7–8 × 1.5–2mm. *Petals* spreading, oblong-oblanceolate, obtuse, 6–7 × 1–1.5mm. *Lip* 3-lobed, adnate to the column. hypochile widely saccate, 6–7 × 4–5mm; lateral lobes shallow; mid-lobe thick, semi-circular to triangular, margins deeply lacinate; disc glabrous; sac 3–5mm deep. *Column* 1–2mm long; anther cap shortly beaked, depressed; caudicle c.1.5mm long; pollinia 0.8–1mm across; viscidium 0.8–1mm long. *Fruit* cylindric, tapering, ridged, 2.5–4 × 0.5–0.7cm.

Bhutan: S - Gaylegphug district (Gaylegphug (M.F.B.), Rani Camp (M.F.B.)); **Darjeeling** (Mongpu, Rayeng Reserved Forest, between Sivok and Bara Mangwa); **Sikkim** (Siring?). 200–1330 m. In tropical valleys, in monsoon forest; 660m. Fl. October–December.

GENERAL DISTRIBUTION. NE India, Myanmar, the Andaman Islands, Thailand, Laos, Vietnam and ?Guam.

ETYMOLOGY. From the Latin *obliquus* (unequal-sided) in reference to the leaf apex.

NOTES. King & Pantling (1898) misidentified a Sikkimese specimen as *Saccolabium dasypogon* without checking their description against the type material. Seidenfaden (1987) clarified the position and we refer this (and other specimens from Bhutan) to G. *obliquus*. The species are clearly closely related and it is possible that G. *obliquus* may be a more widespread colour variant of G. *dasypogon*. Only close study of these plants in the wild will resolve this problem.

Seidenfaden (1988) reported G. *bigibbus* from Sikkim based upon *Clarke* 13196 (K) but thought its identity 'questionable' and we refer it to G. *obliquus*. G. *biggibus* is closely related to G.*obliquus*, the differences being based upon plant and flower size, but we agree with Tsi (1996) in regarding them as synonymyous. G. *obliquus* var. *suavis* (Seidenfaden) Z.H. Tsi was reported by Rao (1997) from Tipi in the W Kameng district of Arunachal Pradesh; it differs from var. *obliquus* in having the sepals and petals densely spotted with bright red dots.

Section **Microphylli** Bentham & Hook. f., Gen. Pl. 3: 579 (1883).

7. **G. affinis** (King & Pantling) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 12: 314 (1918). Type: India, Sikkim, Pemiongtsi (Pemayangtse), *Pentling* 444 (holo. CAL, iso. BM! K!).

Saccolabium affine King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 228, t.304 (1898).

Plant pendent, 6–9cm long; *roots* slender, arising from nodes and piercing through leaf sheaths along stem. *Stem* covered by leaf sheaths; sheaths overlapping, tubular, apex triangular, obtuse, 3–4mm long. *Leaves* several, distichous, oblong-lanceolate to subspathulate, apex minutely 2- or 3-dentate, fleshy, jointed, sessile, 1.8–2.5 × 0.3–0.5cm. *Inflorescence* shortly racemose, 2- or 3-flowered; peduncle slender, glabrous, sheathed, 1–1.5cm long; sheaths distant, triangular, 1–1.5mm long; floral bracts triangular to ovate, subacute, 1–1.5 × 0.4–0.6mm. *Flowers* 5–7mm across; sepals and petals green flushed with brown, lip yellowish; pedicel and ovary slender, glabrous, 0.8–1.3cm long. *Dorsal sepal* ovate-elliptic, obtuse, concave, incurved, 3–4 × 1–1.2mm; *lateral sepals* spreading, ovate-elliptic, obtuse, 3.5–4 × 0.8–1.2mm. *Petals* spreading, ovate-elliptic, obtuse, 3–4 × 1–1.2mm. *Lip* 3-lobed, adnate to the column base, base compressed, saccate, 3–4 × 2–3mm; lateral lobes narrow; mid-lobe decurved, broadly triangular, subacute, margins erose at base; disc with 2 thick median ridges from base to apex; sac conical, bifid, spur-like, at right-angles to ovary. *Column* broad, c.2mm long. *Fruit* ovoid, stalked, 7–8 × 3–4mm.

Bhutan: C – Punakha district (near Wangdi Phodrang (field record)); **Sikkim** (Lachen Valley, Pemayangtse). On *Tsuga dumosa*; 2660–3000m. Fl. July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *affinis* (allied to), a reference to the similarity of this species to *G. distichus* and *G. pseudodistichus*.
NOTE. This species differs from *G. distichus* in having an erose lip margin and 2 median ridges on the mid-lobe of the lip.

8. **G. corymbosus** A.P. Das & Chandra in J. Econ. Taxon. Bot. 12(2): 401 (1988). Type: India, Darjeeling, Jalapahar, *A.P. Das* 823 (holo. CAL).

Roots cylindric, c.1.5mm thick. *Stem* branched, covered by dried leaf sheaths when old, c.2mm thick; branches c.15cm long; internodes 3–4mm long. *Leaves* many, ovate-oblong, fleshy, acuminate, bases sheathing, c.2.2 × 0.8cm. *Inflorescence* axillary, appressed to stem, corymbosely 4-flowered; peduncle, c.1.3cm long; floral bracts oblong, obtuse, c.4mm long. *Flowers* c.1.8 × 1.2cm; sepals and petals brown, blotched ventrally, lip brown; pedicel and ovary c.5mm long. *Sepals* similar, ovate, boat-shaped, acute, c.8 × 4mm. *Petals* ovate, boat-shaped, obtuse, c.8 × 4mm. *Lip* simple, broadly rhombic; disc with a diamond-shaped depressed area; *spur* broad, c.7 × 6mm.

Darjeeling (Jalapahar). 2000m. Fl. October.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *corymbosus* (inflorescence flat-topped).
NOTES. This species differs from *G. distichus* in having a shorter, appressed peduncle and a corymbose, 4-flowered inflorescence. It differs from *G. pseudodistichus* in its ecallose lip.

9. **G. distichus** (Lindl.) Kuntze, Revis. Gen. Pl. 2: 661 (1891). Types: India, Sikkim, *Hooker* 206 (syn. K-LINDL!); Khasia, *Hooker* 83 (syn. K-LINDL!).
Saccolabium distichum Lindl. in J. Proc. Linn. Soc., Bot. 3: 36 (1859).

Plant pendent, 17–26cm long; *roots* filiform, long. *Stems* slender, clustered, pendent, branched, covered by leaf sheaths, 15–25cm long; internodes 4–5mm long; sheaths tubular, overlapping, 4–5mm long. *Leaves* several, distichous, narrowly lanceolate, fleshy, acuminate, with 2 or 3 needle-like points at apex, sessile, 2–2.5 × 0.2–0.5cm. *Inflorescence* racemose, leaf-opposed, 2- to 4-flowered; peduncle glabrous, slender, sheathed, 1.5–2.5cm long; sheaths 2, distant, lanceolate, tubular at base, 3–4mm long; rachis ± sigmoid, 3–4mm long; floral bracts oblong, subacute, 2–3 × 0.5–0.7mm. *Flowers* 1–1.8cm across, green with irregular brown or crimson spots; pedicel and ovary narrow, 4–8mm long. *Sepals* similar, oblong-elliptic, obtuse, 3–4 × 2–2.5mm. *Petals* oblong-elliptic, obtuse, 3–4 × 2–2.5mm. *Lip* simple, adnate to column base, fleshy, semi-circular, margins deflexed, entire, base saccate, 3–6.1 × 4–4.5mm; disc with 2 blunt, conical calluses at base. *Column* broad, c.2mm long. *Fruit* ovoid, 0.8–1.4 × 0.2–0.6cm.

Bhutan: S – Deothang district (Wamrong (M.F.B.)); C – Punakha (Lamperi) and Mongar/Tashigang (Donga La) districts; **Darjeeling** (Damsong Forest, between Ramman and Kali Khola, Senchal); **Sikkim** (between Dentam and Pemayangtse). In shade, on moss-covered trees in dense rain-forest; 1520–2700m. Fl. March–May; Fr. May.

GENERAL DISTRIBUTION. Nepal and N India.
ETYMOLOGY. From the Latin *distichus* (in two opposed ranks) in reference to the leaves.
NOTE. King & Pantling (1898) reported that this spring flowering species, was often found growing with the autumn flowering *G. pseudodistichus*.

10. **G. pseudodistichus** (King & Pantling) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. 12: 315 (1913). Types: India, Sikkim, *Pantling* 49A (syn. CAL, isosyn. W!); Sikkim, *Pantling* 49B (syn. CAL, isosyn. AMES! BM! K! L!).
Saccolabium pseudodistichum King & Pantling in J. Asiat. Soc. Bengal 64(3): 341 (1896).
S. distichum var. *pseudodistichum* (King & Pantling) Finet in Lecomte, Fl. Indo.-Chine 6: 506 (1934).
S. hoyopse Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 387 (1925). Type from Thailand
Gastrochilus hoyopse (Rolfe ex Downie) Seidenfaden & Smitinand, Orch. Thail. 4(1): 623, t.468 (1963).

Plant pendent, branched, 11–20cm long; *roots* slender, arising from nodes. *Stem* slender, covered by leaf sheaths; sheaths tubular, apex obtuse, 6–8mm long. *Leaves* fleshy, lanceolate, apex acuminate to minutely bifid, sessile, jointed, 1.8–2.6 × 0.25–0.4cm. *Inflorescence* racemose, subumbellate, 5- or 6-flowered; peduncle sheathed, 1–1.5cm long; sheaths basal and distant along peduncle, semi-circular to subtriangular, 1–1.5mm long; floral bracts lanceolate, 1–2 × 0.4–0.6mm. *Flowers* 4–5mm across; sepals and petals greenish with brown-purple spots; lip yellow, mid-lobe orange; pedicel and ovary 3–4.5mm long. *Sepals* spreading, similar, oblanceolate, 3–4 × 1–1.8mm. *Petals* spreading, oblanceolate, 3–4 × 1–1.5mm. *Lip* simple, saccate-spurred, 3–4mm across; mid-lobe broadly cordate, obtuse, entire, fleshy, concave, deflexed, ecallose; *spur* sub-hemispheric, 1.5–2mm wide. *Column* c.1mm long; anther cap shortly beaked. *Fruit* ovoid to obovoid, 1–1.8 × 0.5–0.9cm.

Bhutan: – Punakha district (near Gangtey Gompa (field record)); **Darjeeling** (Senchal); **Sikkim** (Neebay?, Yoksam). On *Tsuga dumosa*, in coniferous forest; 2160–2560m. Fl. August–October.

GENERAL DISTRIBUTION. NE India, China, Thailand and Vietnam.
ETYMOLOGY. From the Greek *pseudo-* (false), referring to its similarity to *G. distichus*.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

G. arunachalensis A.N. Rao in J. Econ. Taxon. Bot. 16(3): 723 (1992). Type: India, Arunachal Pradesh, W Kameng district, Dimachang, *A.N. Rao* 24220 (holo. Orchid Herbarium Tipi).

NOTE. This species is related to *G. patinatus* (Ridley) Schltr. but differs in its lip which has a glabrous epichile and acute lateral lobes, with erose margins; we have seen no material of it.

G. intermedius (Griff. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 661 (1891). Type: India, Khasia Hills, Moosmai, *Griffith* 42/152 (holo. K-LINDL!).
Saccolabium intermedium Griff. ex Lindl. in J. Proc. Linn. Soc., Bot. 3: 33 (1859).

NOTE. Plants reported from Sikkim as *G. intermedius* have been identified as *G. linearifolius* by Tsi (1996).

G. rutilans Seidenfaden in Opera Bot. 95: 293, t.190 (1988). Type: Thailand, Khao Tai, *Cumberlege* 962 (holo. C).

NOTE. Rao (1998a) reported this species (previously only known from Thailand) from Kuppi in the E Kameng district of Arunachal Pradesh.

G. sessanicus A.N. Rao in J. Orchid Soc. India 11(1–2): 1 (1997). Type: India, Arunachal Pradesh, W Kameng district, Sessa, *A.N. Rao* 29273 (holo. Orchid Herbarium Tipi).

NOTE. This recently described species is related to G. *alians* F. Maekawa and to G. *minor* Seidenfaden.

114. Luisia Gaudichaud

Plants epiphytic or lithophytic, erect or climbing. *Stems* often branched at base giving a tufted habit, some with a single shoot. *Leaves* distant, terete, linear. *Inflorescences* axillary, racemose, dense, subsessile, fewer than 10-flowered; peduncle and rachis attenuate. *Flowers* small, fleshy. *Sepals* and *petals* free, spreading; petals usually longer and narrower than the sepals. *Lip* fleshy, pendent, immobile; hypochile concave; epichile wrinkled. Column short, stout; lacking a foot; rostellum short; stipes short; viscidium short, broad; pollinia 2, porate.

The genus *Luisia* was established in 1826 by Charles Gaudichaud-Beaupré in Louis de Freycinet's *Voyage sur l'Uranie et la Physicienne*. The genus comprises about 40 species distributed in Sri Lanka, India, Bhutan, China, Thailand, Indo-China, Japan, Malaysia, Indonesia, New Guinea and the Pacific Islands.

TYPE. *Luisia teretifolia* Gaudichaud.
ETYMOLOGY. Named in honour of Don Luis de Torres, a Spanish botanist of the nineteenth century.

Key to species

1. Lip lacking a distinct dividing line between hypochile and epipchile; epichile not suddenly widened .... **1. L. brachystachys**
+ Lip with a distinct dividing line between hypochile and epichile; epichile suddenly widened .. 2

2. Leaves secund (on one side of stem only) .... **2. L. filiformis**
+ Leaves not secund 3

3. Epichile more than 5mm wide .... **3. L. trichorrhiza**
+ Epichile less than 5mm wide .... **4. L. zeylanica**

1. **L. brachystachys** (Lindl.) Bl., Rumphia 4: 50 (1849). Type: Bangladesh, Sylhet, coll. F. *De Silva* Wall. Cat. 1994 (holo. K-LINDL!, iso. K-W! K!).
Mesoclastes brachystachys Lindl., Gen. Sp. Orchid. Pl.: 45 (1830).
Luisia platyglossa sensu Parish in Mason, Burmah:197 (1883), non Rchb. f.
L. indivisa King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 202 (1898). Type: India, Duars, *Anderson* 470 (holo. K!).
L. siamensis Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 384 (1925). Type from Thailand.

Plant epiphytic, clustered, 20–28cm tall; *roots* basal. *Stem* stout, branched or unbranched, covered by leaf sheaths; sheaths striate, tubular, adherent, glandular-pubescent, overlapping, 1–1.5cm long. *Leaves* terete, straight to curved, jointed, 6–12 × 0.08–0.12cm. *Inflorescence* leaf-opposed, short, 4- or 5-flowered; peduncle thick, attenuate, sheathed, 1–2mm long; rachis thick, 4–5mm long; floral bracts triangular, 1–1.5 × 1–1.5mm. *Flowers* 3–4mm long; sepals pale green, purple within, petals yellow-green, lip yellow-green to purple; pedicel and winged ovary glabrous, 4–6mm long. *Dorsal sepal* oblong, obtuse, 2–4.6 × 0.8–1mm; *lateral sepals* spreading, oblong-elliptic, obtuse, 2.8–3 × 0.8–1mm. *Petals* narrowly oblong-spathulate, falcate, rounded to subacute, 3-veined, 3–4.5 × 0.8–1mm. *Lip* simple, broadly oblong and widened at apex (occasionally indented just below widening), apex subacute to obtuse, entire, upper surface slightly concave at base, 3.5–3.8 × 1.5–2mm; disc ecallose or indented at base. *Column* 1.5mm long; stigma transversely elliptic; anther cap 2 × 1.5mm. Fruit cylindric, ridged, 2.5–3.5 × 0.3–0.4cm.

Bhutan: C – Punakha district (Samtengang to Chusom); **Duars** (unlocalised *Anderson* specimen). 1300–1900m. Fl. March–April.

GENERAL DISTRIBUTION. N India, Myanmar, Thailand, Laos and Vietnam.
ETYMOLOGY. From the Greek *brachy-* (short) and *stachys* (spike) in reference to the inflorescence.

2. **L. filiformis** Hook. f., Fl. Brit. India 6(1): 23 (1890). Type: India, Khasia Hills, *Mann* s.n. (holo. K!).
Luisia grovesii Hook. f., Fl. Brit. India 6(1): 25 (1890). Type: E Bengal (Mizoram), Lushai Hills, *G.B. Groves* s.n. (holo. CAL).
L. volucris sensu King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 204 (1898), non Lindl.
L. gamblei Durand in Index Kew. Suppl. 1: 256 (1906), *sphalm*.

Plant epiphytic or lithophytic, pendent; roots basal. *Stem* branched, covered by leaf sheaths, 2–3mm thick; sheaths tubular, striate, 1.5–3.5cm long. *Leaves* from one side of stem only, linear, terete, rugose, jointed, 17–27 × 0.07–0.1cm. *Inflorescence* piercing through leaf-sheath 2–4mm above its base, thick, 5- to 8-flowered; peduncle attenuate, sheathed; rachis 5–8mm long; floral bracts broadly ovate, boat-shaped, subacute, 1.5–2 × 1.5–2mm. *Flowers* 3–5mm across; sepals white, petals white with yellow tips, lip deep purple with white edges; pedicel and ovary 2–4mm long. *Dorsal sepal* ovate-elliptic, weakly hooded, subacute, keeled, 5 × 1.5mm; *lateral sepals* spreading, ovate-elliptic, obtuse, keeled, 5–5.5 × 1.5–2mm *Petals* widely spreading, filiform, obtuse, 5–11 × 0.25–0.5mm. Lip 3-lobed, ecallose, 4–6 × 1.5–2mm: hypochile broadly triangular to wedge-shaped, margins recurved, lateral lobes short, rounded; epichile arising from narrowed hypochile, broadly obovate, surface ridged, apex truncate to notched, margins weakly undulate, 3 × 2mm. *Column* 1–1.5 × 1–1.5mm; anther cap subquadrate. Fruit obovoid, ridged, 3 × 0.5cm.

Bhutan: S – Phuntsholing district (Phuntsholing); C – Tashigang district (near Tashi Yangtsi (M.F.B.)); **Sikkim** (unlocalised *Pantling* specimens). In tropical valleys; 500–2000m. Fl. March–April; Fr. April

GENERAL DISTRIBUTION. India (NE and Orissa), Thailand, Laos and Vietnam.
ETYMOLOGY. From the Latin *filiformis* (thread-like) in reference to the leaves.
NOTE. King & Pantling (1898) reported L. *volucris* Lindl. from Sikkim but this was a misidentification of a specimen now considered to be L. *filiformis*.

3. **L. trichorrhiza** (Hook.) Bl., Rumphia 4: 50 (1849). Type without provenance, *Shepherd* (holo. LIV?, not found); Lectotype: [icon. in] Hook., Exot. Fl. 1: t.72 (1825)!, designated by Seidenfaden in Dansk. Bot. Ark. 27(4): 67 (1971).
Vanda ? *trichorrhiza* Hook., Exot. Fl. 1: t.72 (1825).
Cymbidium triste sensu Lindl., Gen. Sp. Orchid. Pl.: 167 (1833), non (Forster) Willdenow.

Plant epiphytic; roots basal, clustered, hairy. *Stem* stout, unbranched (occasionally branched), covered by leaf sheaths, 4–7mm wide; sheaths tubular, striate-rugose, 1.2–1.6cm long. *Leaves* distichous, fleshy, terete, rugose, jointed, 8–13 × 0.1–0.3cm. *Inflorescence* leaf-opposed, stout, short, 4- or 5-flowered; peduncle attenuate; rachis thick, 7–9 × 3–4mm; floral bracts persistent, broadly ovate-triangular, boat-shaped, acuminate, 1.5–2 × 1–1.5mm. *Flowers* 1.5cm across; sepals pale green with faint purple lines, lip dark purple, the base outlined with green lines, the apical ridges green, column purple; pedicel and ovary 5–6mm long. *Dorsal sepal* oblong, obtuse, 3-veined, 6.5–9 × 1.2–1.8mm; *lateral sepals* spreading, obliquely ovate to spathulate, acute, keeled, 3-veined, 7–8 × 1.3–2mm. *Petals* oblong, obtuse, spreading, 3-veined, 7 × 1.3mm. Lip 3-lobed, 6–8 × 3–4mm (across epichile when spread); hypochile deeply concave with erect, rounded to triangular, subacute lateral lobes; epichile cordate, ridged, tapering to subtruncate, minutely emarginate apex. Column stout, 1.5–2mm long. Fruit cylindric, ridged, 1.6–3.5 × 0.4–0.8cm.

Bhutan: S – Chukka district (Raidak Valley); **Darjeeling** (unlocalised *Gamble* specimen); **Sikkim** (Rathang Chhu to Thinglen Bridge). Epiphytic on introduced *Samanea saman*; 1000–1330m. Fl. March–May(–July); Fr. May.

GENERAL DISTRIBUTION. India, Myanmar and Thailand.
ETYMOLOGY. From the Greek *tricho-* (hair) and *rhiza* (root).
NOTES. Plate 72 in Vol.1 of *Exotic Flora* was probably drawn from the type material of this species and shows a plant with hairy roots, a cordate lip and a rather narrow hypochile. It is similar to plate 3648 of the *Botanical Magazine* which Seidenfaden (1988) took to be the type of the closely related L. *platyglossa* Rchb. f. Seidenfaden (1971) discussed the taxonomic difficulties of this species and a close study of living material will be required to resolve these problems.

4. **L. zeylanica** Lindl., Fol. Orchid. Luisia 4: 3, no.7 (1853). Type: Sri Lanka (Ceylon), *Macrae* 50 (holo. K-LINDL!).

Plant epiphytic, 20–35cm tall. *Stems* stout, covered by leaf sheaths; internodes 1–1.5 × 0.4–0.6cm; sheaths overlapping, surface rugose. *Leaves* distichous, terete, subacute, sessile, 6–15 × 0.1–0.5cm. *Inflorescence* extra-axillary, arising in centre of internode, on same side as the leaf, 2- to 4-flowered; peduncle attenuate, 2–3mm long; floral bracts broadly ovate-lunate, 0.5–1 × 1–1.8mm. *Flowers* pendent, 3–6mm across; sepals and petals green, mottled with purple, lip deep purple; pedicel and ovary slender, 3–4mm long. *Dorsal sepal* ovate, concave, 3–5 × 1.5–3mm; *lateral sepals* lanceolate-ovate, keeled, margins inrolled, 3–5 × 2–3mm. *Petals* oblong-lanceolate, obtuse, 3–4 × 1–1.2mm. *Lip* fleshy, obscurely 3-lobed, 3–4 × 1.5–2.5mm; hypochile subquadrate, concave; epichile deflexed, cordate-triangular, apex obscurely 3-lobed to subtruncate. *Column* stout, c.1mm long. *Fruit* cylindric, 1.8–2.4 × 0.3–0.4cm. **Fig. 117; Plate 29.**

Bhutan: S – Sarbhang district (Chirang, Singi Khola, 10km SW of Sarbhang); C – Thimphu/ Punakha (Dochu La), Punakha (Punakha to Tinlegang) and Mongar (E of Lhuntse (M.F.B.)) districts: **Darjeeling** (unlocalised *Hara et al.* specimen); **Sikkim** (Dentam to Pemayangtse). In tropical and subtropical terai forest and valleys, on *Terminalia chebula*; 390–3050m. Fl. April–May.

GENERAL DISTRIBUTION. Sri Lanka and NE India.
ETYMOLOGY. From Zeylona, an old name for Sri Lanka.
NOTE. King & Pantling (1898) reported L. *teretifolia* Gaudichaud from Sikkim but Seidenfaden (1971) considered this to be due to misidentification and referred their record to L. *zeylanica*.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

L. amesiana Rolfe in Bull. Misc. Inform. Kew 1893: 173 (1893). Type: Myanmar (Burma), Southern Shan States, cult. Low (holo. K!).

NOTE. Reported by Bose & Bhattacharjee (1980) from the E Himalaya. We have seen no material from our area and Seidenfaden (1971) recorded it only from Myanmar.

L. birchea (A. Richard) Bl., Rumphia 4: 50 (1849) nom. nud.; Mus. Bot. 1: 64 (1849). Type: S India, Nilghiri Hills, *Richard* 73 (holo. P).
Birchea teretifolia A. Richard in Ann. Sci. Nat. (Paris) sér.2, 15: 67, t.10 (1841).

NOTE. Reported by Bose & Bhattacharjee (1980) from Sikkim. Seidenfaden (1971) recorded it only from S and W India and we suspect that the report is based on a misidentification.

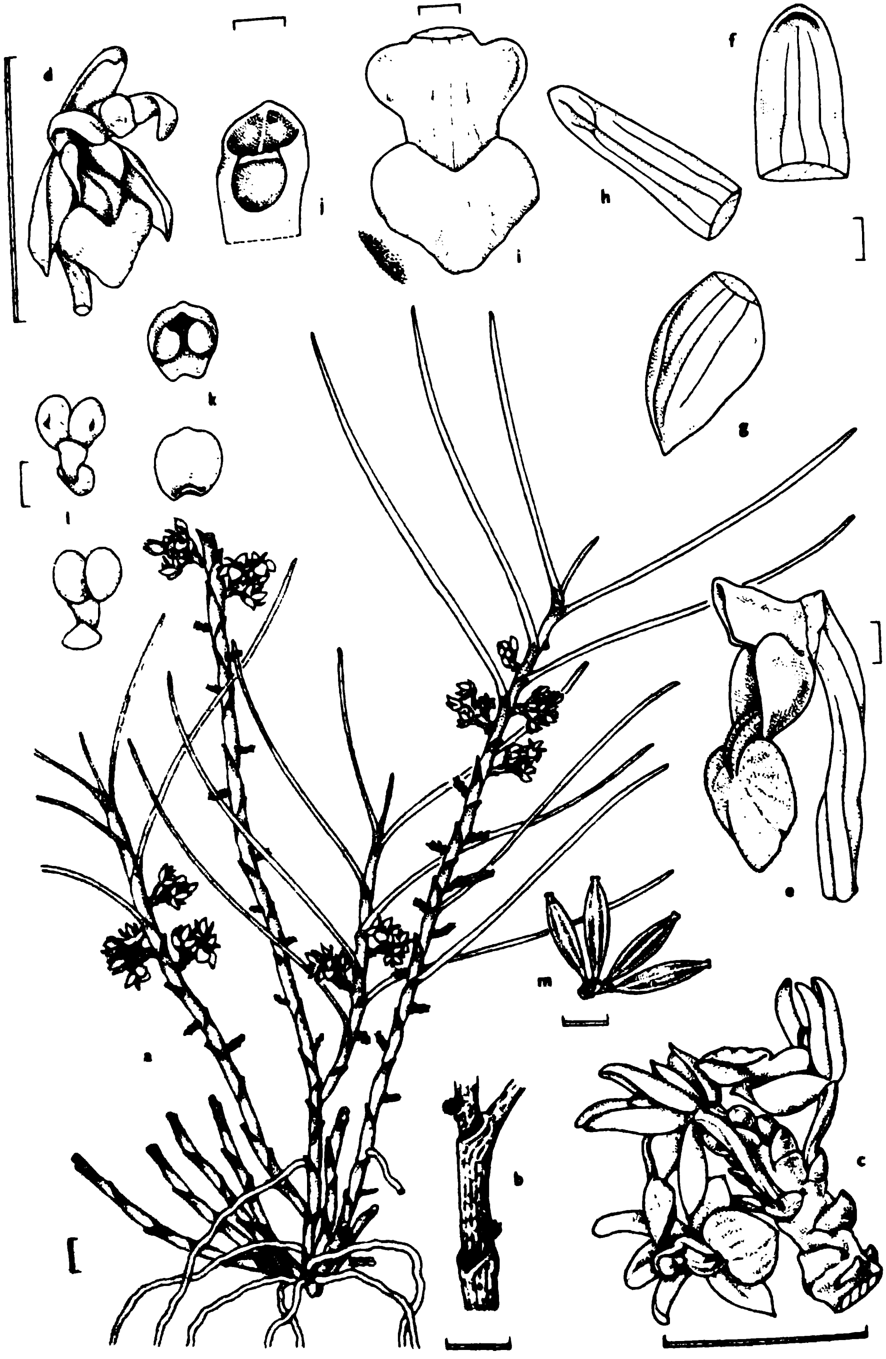

Fig. 117. *Luisia [illegible]*: a, habit; b, stem (detail), c, inflorescence (detail); d, flower; e, lip, column and ovary; f, dorsal sepal; g, lateral sepal; h, petal; i, lip (with surface detail); j, column; k, anther (two views); l, pollinarium (two views); m, fruit. Drawn by Susanna Stuart-Smith, a–c from *Kanai et al.* 14887 (TI), d–m from *Hara et al.* 1653 (TI).

L. psyche Rchb. f. in Bot. Zeitung (Berlin) 98 (1863). Type: Myanmar, Moulmein, *Parish* 121(holo. W! Herb. no. 51719!).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

115. **Micropera** Lindl.

Plants small, climbing, monopodial, epiphytic. *Stem* bearing many support roots at intervals. *Leaves* linear. *Inflorescence* lateral, leaf-opposed, racemose. *Flowers* small, non-resupinate, fleshy. *Lateral sepals* connate for a short distance at base. *Lip* saccate; apex 3-lobed, mid-lobe short; *spur* saccate with a back wall callus, a longitudinal septum and (usually) a 2-lobed, front wall callus. *Column* variable, usually with a foot; rostellum elongate, slender, twisted unilaterally; stipes linear; viscidium small, ovate; pollinia 4, as 2 unequal masses.

The genus *Micropera* was established in 1832 by John Lindley in the *Botanical Register*. The genus comprises about 15 species distributed from NE India and Indo-China, south to Indonesia, the Philippines, New Guinea, Australia and the Solomon Islands.

TYPE. *Micropera pallida* (Roxb.) Lindl.; basionym: *Aerides pallida* Roxb.
ETYMOLOGY. From the Greek *micro-* (small) and *pera* (sac) in reference to the lip.

Key to species

1. Stem pendent; flowers less than 1cm across .... **1. M. mannii**
+ Stem erect; flowers more than 1cm across .... **2. M. obtusa**

1. M. mannii (Hook. f.) T. Tang & F.T. Wang in Acta Phytotax. Sin 1(1–2): 94 (1951). Type: India, Khasia Hills, *Mann* 11 (holo. K!).
Sarcochilus mannii Hook. f., Fl. Brit. India 6(1): 36 (1890).
Camarotis mannii (Hook. f.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 239, t.317 (1898).

Plant pendent; *roots* piercing through leaf sheaths. *Stem* branched, covered by leaf sheaths, 20–30cm long; sheaths striate, tubular-appressed, 1.6–2cm long. *Leaves* distichous, linear-oblong, keeled beneath, obtuse to subacute, minutely bifid at apex, sessile, jointed, 7.5–11.5 × 0.8–1.3cm. *Inflorescence* straight, laxly 8- to 18-flowered; peduncle attenuate, sheathed at base; rachis glabrous, 2–8.5cm long; floral bracts ovate, acute to apiculate, 2.5–3 × 1–1.5mm. *Flowers* 6–7mm across, uniformly pale pink, sepals, petals and lip spotted basally with crimson; pedicel and ovary dark glandular-pubescent, 3–6mm long. *Dorsal sepal* obovate, reflexed, 3–4.5 × 0.8–1mm; *lateral sepals* similar, connate at base, 3.5 × 1.2mm. *Petals* linear-obovate, obtuse, reflexed, 4 × 0.8mm. *Lip* deeply saccate, elongate, at right-angles to the ovary, front wall cut away at a right-angle in upper half, margins of mouth with 2 minute, oblong, obliquely truncate, erect lateral lobes, 4–5mm long; mid-lobe minute, broadly triangular; callus projecting into spur cavity. *Column* twisted, lacking a foot, 1.5mm long; rostellum sigmoid, beak-like. **Fig. 118.**

Bhutan: C – Punakha (Chusom) and Mongar (Shongar Chu valley, above Lingmethang) districts; **Sikkim** (Lingmo, Tista Valley). On trees in shady warm broad-leaved forest; 330–1100m. Fl. June–July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after Gustav Mann (1836–1916) who worked for the Indian Forest Service between 1863 and 1891 and collected the type specimen in Khasia.

2. M. obtusa (Lindl.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 94 (1951). Type: India, unlocalised, cult. Loddiges (holo. K, probably lost); Lectotype (selected here): icon. Lindley '*Camarotis obtusa*' (lecto. K-LINDL!).

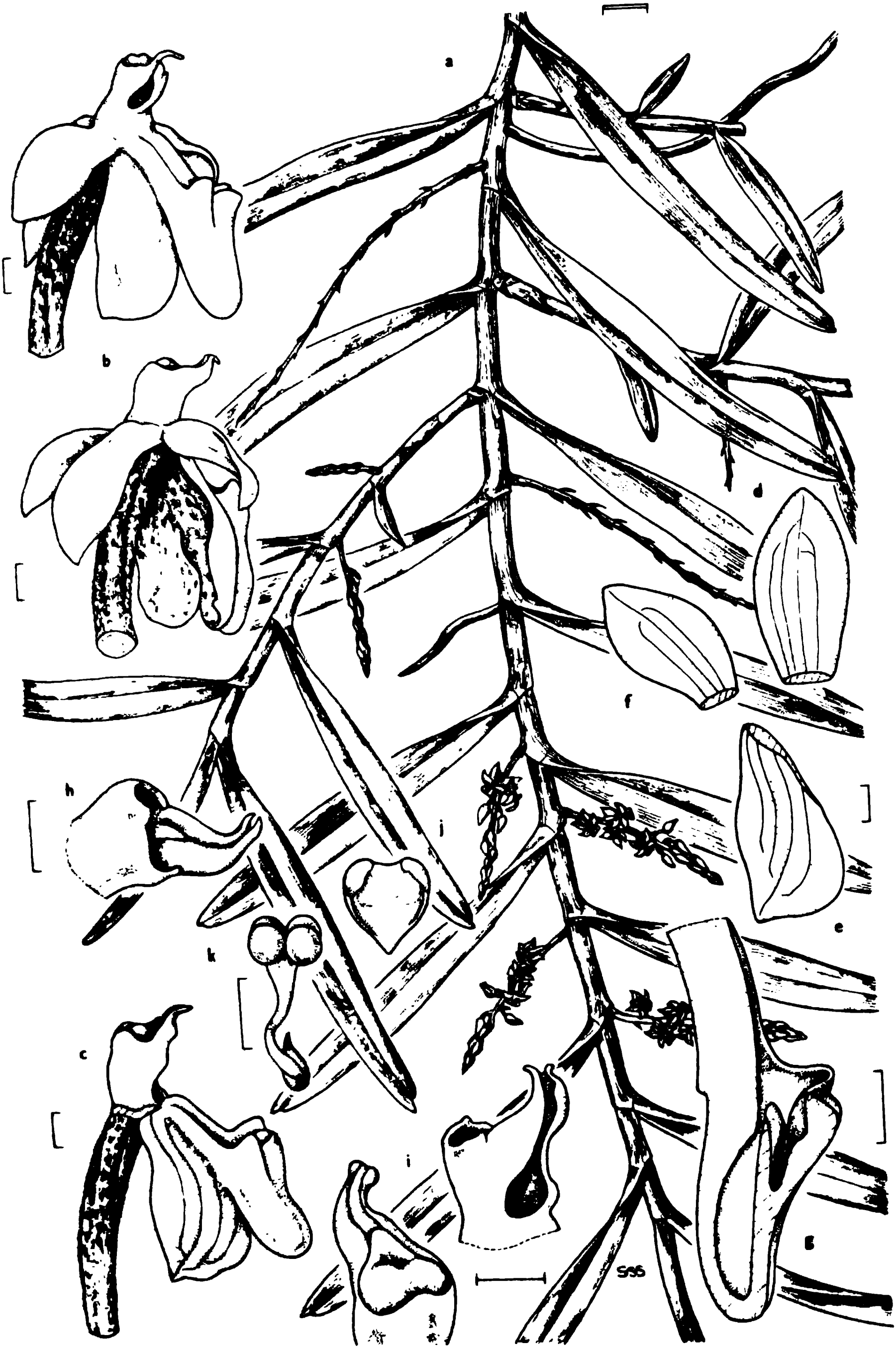

Fig. 118. ***Micropera mannii***: a, habit; b, flower (two views); c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip (sectioned); h, column; i, column (two views); j, anther cap; k, pollinarium. Drawn by Susanna Stuart-Smith from *Grierson & Long* 2437 (E, K).

Camarotis obtusa Lindl. in Bot. Reg. 30: misc.73, no.71 (1844).
Sarcochilus obtusus (Lindl.) Bentham ex Hook. f., Fl. Brit. India 6(1): 36 (1890).
Camarotis obliquirostris Parish ex King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 238 (1898), *pro. syn*.

Plant 15–20cm tall; *roots* piercing through leaf sheaths, branched. *Stem* erect, covered by leaf sheaths; sheaths striate, tubular-appressed, 1.5–2cm long. *Leaves* linear-oblong, slightly and obliquely bifid at apex, sessile, jointed, 7.5–12 × 0.5–0.9cm. *Inflorescence* horizontal, laxly 10- to 15-flowered (only a few opening together); peduncle sheathed, 7–9mm long; rachis ridged, 4–8cm long; floral bracts ovate, acute, reflexed, 2–2.5 × 1–1.6mm. *Flowers* 1.2–1.8cm across; sepals and petals pink, lip yellow or white with yellow spots or markings; pedicel and ovary scurfy, 5–9mm long. *Dorsal sepal* reflexed, broadly oblong, margins reflexed, 6–8 × 1–1.8mm; *lateral sepals* oblong, weakly falcate, obtuse, adnate for about a third of their length to the column and connivent under it, 5–7 × 1.5–2mm. *Petals* oblong, obtuse, 4–5 × 1–1.5mm. Lip fleshy, adnate to the column base (forming a right-angle with it), saccate, 5–7.5mm long; front wall cut away in upper part; sac opening occluded by 2 large calluses from back and front walls, septate; lateral lobes (along mouth of spur) narrow, incurved; epichile minute, narrowly triangular, minutely 3-lobed. *Column* 1.5mm long; rostellum long, hooked at apex, twisted; anther cap beaked, hooked-apiculate, 2.5mm long. **Plate 29.**

Bhutan: S – Sarbhang district (Lam Pati, 10km E of Sarbhang); **Sikkim** (unlocalised Pantling specimens). In tropical valleys and subtropical terai forest; 410m. Fl. June–August.

GENERAL DISTRIBUTION. NE India, Myanmar and Thailand.
ETYMOLOGY. From the Latin *obtusus* (rounded) but not clear to which organ this refers.
NOTE. The type material associated with Lindley's *Camarotis obtusa* has been lost so we have selected a lectotype here.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

M. rostrata (Roxb.) N.P. Balakrishnan in J. Bombay Nat. Hist. Soc. 67(1): 66 (1970). Type: India, Khasia, Silhet, M.R. Smith (holo. not found); Lectotype: [icon. of] '*Aerides rostratum*' Roxburgh 2348 (lecto. K!), designated by Seidenfaden in Opera Bot. 95: 126 (1988).
Aerides rostrata Roxb., Hort. Bengal.: 63 (1814), *nom. nud.*; Fl. Ind. ed. 1832, 3: 474 (1832).
Camarotis purpurea Lindl. in Wall. Cat.: 7329 (1832), *nom. nud.*; Gen. Sp. Orchid. Pl.: 219 (1833). Type: Bangladesh, Sylhet, coll. *W. Gomez* Wall. Cat. 7329 (holo. K-LINDL!, iso. K-W!).
Micropera pallida sensu Lindl., Gen. Sp. Orchid. Pl.: 219 (1833), *non* Lindl. (1832).
Camarotis pallida (Lindl.) Lindl. in J. Proc. Linn. Soc., Bot. 3: 219 (1859).
C. rostrata (Roxb.) Roxb. in Walpers, Ann. Bot. Syst. 6: 881 (1864).
Sarcochilus purpureus (Lindl.) Bentham ex Hook. f., Fl. Brit. India 6(1): 37 (1890).
Micropera purpurea (Lindl.) Pradhan, Indian Orch.: Guide Identif. Cult. 2: 498, 619 (1979).

NOTES. Reported by Rao & Deori (1980) from Jamiri in the W Kameng district of Arunachal Pradesh. It differs from *M. obtusa* in having a glabrous (rather than scurfy) pedicel and the lip is purple, rather than yellow.

116. **Ornithochilus** (Lindl.) Bentham

Plants small, epiphytic, monopodial. *Stem* short, unbranched. *Leaves* fleshy. *Inflorescence* axillary, paniculate, many-flowered, equalling or exceeding leaves. *Flowers* small to medium. *Sepals and petals* free; petals smaller and narrower than the sepals. *Lip* spurred from distal part of hypochile; epichile 3-lobed, margins ciliate or crenulate. *Column* small, fleshy, lacking a foot; rostellar projection elongate, fleshy, obtuse; anther cap truncate; stipes obovate-cuneiform; viscidium obtriangular; pollinia 4, as 2 pollen masses.

The genus *Ornithochilus* was established in 1881 by G. Bentham in his *Genera Plantarum* when he raised section *Ornithochilus* of *Aerides* (originally proposed by J. Lindley in 1833 in *Genera and Species of Orchidaceous Plants*) to generic rank. The genus comprises about three species distributed from the Indian Himalayas and China, through SE Asia to Malaysia, Sumatra and Borneo.

TYPE. *Ornithochilus difformis* (Wall. ex Lindl.) Schltr.; basionym: *Aerides difforme* Wall. ex Lindl.
ETYMOLOGY. From the Greek *ornitho-* (bird-like) and *cheilos* (lip) in reference to the divaricately lobed lip which resembles a bird in flight.

1. **O. difformis** (Wall. ex Lindl.) Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 277 (1919).
Type: Nepal, icon. Wallich 657 (holo. K!).
Aerides difforme Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 242 (1833).
A. hystrix sensu Lindl. in J. Proc. Linn. Soc., Bot. 3: 42 (1858), non (Bl.) Lindl.
Ornithochilus fuscus Lindl., Gen. Sp. Orchid. Pl.: 242 (1833), nom. nud.
O. eublepharon Hance in J. Bot. 22: 364 (1884). Type: China, Lofaushan, Ford 22249 (holo. HK).
O. delavayi Finet in Bull. Soc. Bot. France 43: 496, t.11 (1896). Type: China, Yunnan, *Delavay* 4341 (holo. P).
Sarcochilus difformis (Wall. ex Lindl.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 92 (1951).
Trichoglottis difformis (Wall.ex Lindl.) Ban & Huyen, Fl. Tayngyuen: 206 (1984).

Plant to 35cm long; *roots* clustered, c.2mm in diameter. *Stem* covered by leaf sheaths, 1–8cm long. *Leaves* oblong-elliptic or obovate-elliptic, falcate, acuminate to obtuse, apex unequally 2-lobed, 5.5–18 × 2.4–4.6cm. *Inflorescence* laxly many-flowered; branches spreading, bases sheathed, c.21cm long; sheaths tubular, 2–3, overlapping, 3–6mm long; rachis glabrous, 9–25cm long; floral bracts triangular, acute, 1–2.5mm long. *Flowers* 0.7–1cm across; sepals and petals yellow to green with several longitudinal red-brown striations, lip dark maroon with yellow markings at base and margins, spur maroon and green; pedicel and ovary 0.7–1.2cm long. *Dorsal sepal* oblong-elliptic, obtuse, incurved, 3–5 × 2mm; *lateral sepals* spreading, obliquely oblong-ovate, subacute, 3.5–6 × 2–3mm. *Petals* linear, obtuse, 3–4 × 1mm. *Lip* 2-lobed, spurred, 4–7 × 4mm; hypochile at right-angles to the column with 2 narrowly elliptic, erect lateral lobes; epichile at right-angles to hypochile, 3-lobed, lateral lobes erect, spreading, falcate, margins lacerate-fimbriate; disc (on epichile) with a central, longitudinal, broadly triangular raised keel; spur at base of hypochile, cylindric, decurved, 3–5mm long. *Column* ventrally papillose, c.4mm long. *Fruit* cylindric, 2.1–2.6 × 0.2–0.3cm. **Fig. 119.**

Bhutan: C – Punakha district (Lobesa); **Darjeeling** (Mongpu); **Darjeeling/Sikkim** (Great Rangit River); **Sikkim** (Yoksam). On *Quercus griffithii*; 1000–2000m. Fl. June–July.

GENERAL DISTRIBUTION. NW Himalaya, Nepal, E Himalaya, Myanmar, China, Thailand, Vietnam, Malaysia, Sumatra and Borneo.
ETYMOLOGY. From the Latin *difformis* (of unusual form or shape) but the precise reference is unclear.

117. **Papilionanthe** Schltr.

Plants epiphytic, scrambling, monopodial, erect or pendent, branched or unbranched. *Leaves* distichous, terete, fleshy to coriaceous, jointed or sheathed at base. *Inflorescence* axillary, 1- to several-flowered. *Flowers* large, flat. *Sepals* and *petals* spreading, subsimilar, free. *Lip* 3-lobed, continuous with the column foot. *Column* short, fleshy, with a short foot; rostellum elongate; pollinia 2, grooved; stipe broadly triangular to subquadrate; viscidium large.

The genus *Papilionanthe* was established in 1915 by Rudolf Schlechter in the journal *Orchis*. The genus comprises about eleven species distributed in India, SE Asia and the Malay Archipelago.

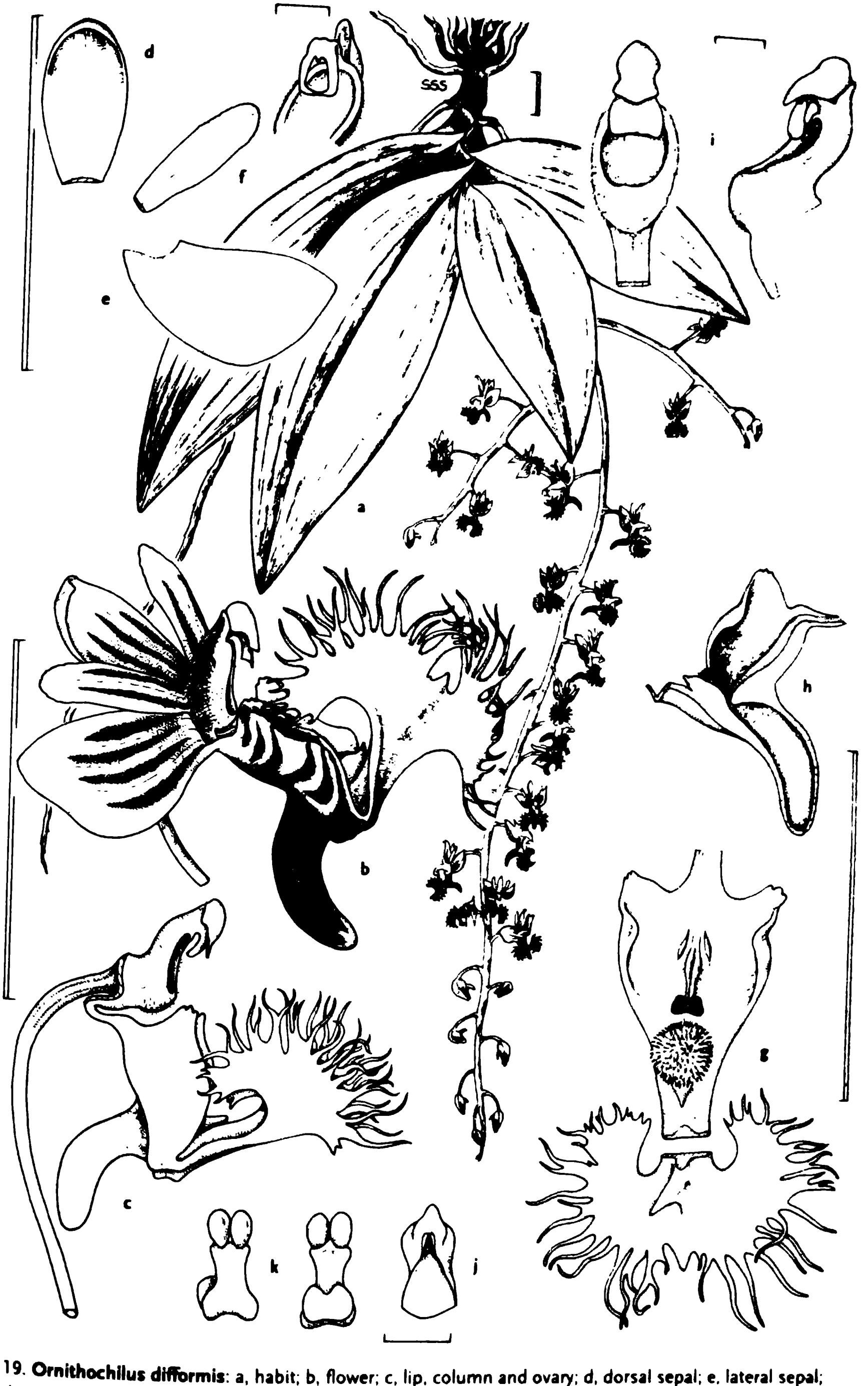

Fig. 119. **Ornithochilus difformis**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip (sectioned); i, column (two views); j, column apex (detail); k, pollinarium (two views). Drawn by Susanna Stuart-Smith, a from *Gamble* 10451 (K); b–k from *Grey-Wilson & Phillips* 127 (K).

Pollination of *P. teres* (Roxb.) Schltr. by *Xylocopa* (Carpenter) bees has been suggested by van der Pijl & Dodson (1966) who reported that dead bees had been found in the flowers and that the fragrance was similar to that of specialised *Xylocopa*-pollinated flowers.

TYPE. *Papilionanthe teres* (Roxb.) Schltr.; basionym: *Dendrobium teres* Roxb.
ETYMOLOGY. From the Latin *papilio* (butterfly) and the Greek *anthos* (flower).

Key to species

1. Lateral lobes of lip entire 2
+ Lateral lobes of lip bifid to 2-lobulate 3

2. Flowers less 2cm across; inflorescence 1-flowered .... **1. P. greenii**
+ Flowers more than 2cm across; inflorescence more than 3-flowered .... **2. P. teres**

3. Flowers more than 3cm across; lobules of lateral lobes linear .... **3. P. uniflora**
+ Flowers less than 3cm across; lobules of lateral lobes serrate-denticulate .... **4. P. vandarum**

1. P. greenii (W.W. Smith) Garay in Bot. Mus. Leafl. 23(10): 371 (1974). Type: 'Bhutan', native collectors, cult. H.F. Green (holo. CAL?).
Aerides greenii W.W. Smith in Rec. Bot. Surv. India 4: 271 (1911).

Plant to 20cm tall. *Stem* slender, rigid, 20cm long. *Leaves* terete, fleshy, grooved, tapering, acute, 6–10 × 0.3cm. *Inflorescence* 3cm long, suberect, 1-flowered; peduncle short, clothed with a few, short, brown scales. *Flower* less than 2cm across; sepals streaked with purple, lip creamy-white with purple markings below and bright yellow above, spur purple. *Dorsal sepal* slightly longer than wide, orbicular, apex notched; *lateral sepals* similar, margins undulate, apex thickened, obtuse. *Petals* similar to dorsal sepal but narrower, spreading. *Lip* shorter than sepals, joined to the column foot; lateral lobes large, obliquely oblong; mid-lobe fleshy, ridged. (Description adapted from the protologue).

Bhutan (unlocalised type specimen).

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. Named after Henry Frederick Green (1865–1943) who was manager of the Government Cinchona Plantation in Munsang, Darjeeling and collected the type specimen.
NOTES. Smith in the original description said that this species was related to *Aerides cylindricum* Lindl. (*P. cylindrica* (Lindl.) Seidenfaden) but that the flowers were smaller. Seidenfaden (1995b) discussed the differences between *P. cylindrica* the closely related *P. subulatum* (now treated as *P. teres* (Roxb.) Schltr.); he felt that they were distinct and that *P. cylindrica* occured only in Sri Lanka and the Deccan. We have seen no material of *P. greenii*, but suspect that it may be no more than a small-flowered *P. teres*, further collections, however, are needed before making any nomenclatural changes.

2. P. teres (Roxb.) Schltr. in Orchis 9: 78, t.12 (1915). Types: Bangladesh, Chittagong, *Roxburgh* 152 (syn. BM!); [icon. of] '*Vanda teres*' Roxburgh 2355 (syn. CAL K!).
?*Epidendrum subulatum sensu* König in Retzius, Observ. Bot. 6: 51 (1791), non Sw 1788. Type: Thailand, Phuket, *König* s.n. (holo. not located).
?*Limodorum subulatum* (König) Willdenow, Sp. Pl. ed.4(1): 126 (1805).
Dendrobium teres Roxb., Fl. Ind. ed. 1832, 3: 485 (1832).
Vanda teres sensu Lindl., Gen. Sp. Orchid. Pl.: 217 (1833), non Roxb. (1832).
?*Papilionanthe subulata* (Willdenow) Garay in Bot. Mus. Leafl. 23(10): 372 (1974).
P. subulata sensu Seidenfaden, Descr. Epidendr. König: 31 (1995), non Garay (1974).

Plant scrambling; *roots* piercing through leaf sheaths. *Stem* branched, terete, long, covered by leaf sheaths, 4mm wide; sheaths ridged, tubular, 3.5–4cm long. *Leaves* suberect, curved, terete, linear, ridged, jointed, 7.5–20 × 0.2–0.4cm. *Inflorescence* leaf-opposed, racemose, laxly 3- to 6-flowered; peduncle ridged, sheathed, 5.5–8.5cm long; sheaths 2, broadly ovate, truncate, 3 × 3mm; rachis ridged, glabrous, 3.5cm long; floral bracts ovate, 4 × 1.5mm. *Flowers* 4–10cm across; sepals and petals white to pink, lip darker pink with a yellow base veined with pink, spur with a yellow mouth; pedicel and ovary 1.8–3.2cm long. *Dorsal sepal* spreading, ovate to sub-rhombic, obtuse, margin undulate, 3.4–3.8 × 3–3.1cm; *lateral sepals* similar. *Petals* suborbicular, rounded, margins undulate, base twisted, 2.8–4.5 × 2.5–3.8cm. *Lip* 3-lobed, pubescent, 3.8 × 3.2cm; lateral lobes erect, semi-circular; mid-lobe flabellate-obcordate, deeply cleft, 1.8 × 2cm (across lobules); *spur* funnel shaped, compressed, 1.5–2.5cm long. *Column* pubescent in front, 8–9mm long. *Fruit* strongly ridged, cylindric, stalked, 6–6.5 × 0.9–1.1cm; stalk 1.5cm long. **Fig. 120.**

Bhutan: S – Gaylegphug district (Gaylegphug (M.F.B.)); **Darjeeling** (unlocalised *Gamble* specimen); **Sikkim** (unlocalised *Pantling* specimens). In tropical valleys, on tall forest trees; 270–2330m. Fl. May–July.

GENERAL DISTRIBUTION. Nepal, India, Bangladesh, Myanmar, China (Yunnan), Thailand and Vietnam.

ETYMOLOGY. From the Latin *teres* (terete) in reference to the leaf.

NOTES. Seidenfaden (1995b) discussed the history of this species and made the above transfer, though the taxonomy of the species is complex and remains unresolved. Christenson (1999) proposed conservation of the name *D. teres* against *Limodorum subulatum* and outlined his reasoning. Ormerod (pers. comm.) has re-examined König's original description and believes that this plant is a *Cleisostoma* species which cannot be identified to species level. If the latter is true then the synonyms marked with a query represent a species of *Cleisostoma*, but since the name *C. subulata* is preoccupied, there are no nomenclatural ramifications.

3. **P. uniflora** (Lindl.) Garay in Bot. Mus. Leafl. 23(10): 372 (1974). Type: Nepal, Gossainthan, *Wallich's collectors* Wall. Cat. 1993 (holo. K-LINDL!, iso. K-W!).

Mesoclastes uniflora Lindl., Gen. Sp. Orchid. Pl.: 45 (1830).

Luisia uniflora (Lindl.) Bl., Rumphia 4: 50 (1849).

Aerides longicornu Hook. f., Fl. Brit. India 6(1): 44 (1890). Type: India, Assam, Naga Hills, *Clarke* 41790 (holo. K!).

A. uniflora (Lindl.) Summerhayes in Kew Bull. 10: 588 (1955).

Plant pendent, to 1m long. *Stem* branched, covered by leaf sheaths, 2–3mm wide; sheaths ridged, tubular, widened above, 1.8–2.2cm long. *Leaves* erect, terete, weakly curved, acute, jointed, 10.5–16 × 0.1–0.2cm. *Inflorescence* 1- or 2-flowered; peduncle slender, sheathed, 2.8–4cm long; floral bract ovate, 2 × 1mm. *Flower* scentless, 1–1.5cm across, white tinged with pink or blue, apex of spur yellowish; pedicel and ovary filiform, glandular-pubescent, 2.5–3.5cm long. *Dorsal sepal* erect, oblong, 5-veined, apiculate, 9 × 4mm; *lateral sepals* spreading, oblong, weakly falcate, flexuous, 5-veined, 1.1 × 0.3cm. *Petals* oblong, tapering, 7-veined, obtuse, margins undulate, attached to column foot, base broad, 9 × 4.5mm. *Lip* adnate to column foot, long-spurred, 3-lobed; lateral lobes deeply bifid, unequal, linear, hooked, acute; long horn 5 × 0.17mm; short horn filiform, 3 × 0.01mm; mid-lobe simple, oblong, decurved, apex widely cuneate, 4 × 1mm; *spur* funnel shaped, elongate, 2 × 0.25cm. *Column* 4 × 3mm; foot 5mm long; anther cap beaked; pollinia 1 × 0.6mm. *Fruit* stalked, cylindric, 3.5–5.2 × 0.4–0.7cm; stalk 0.7cm long. **Plate 29.**

Bhutan: C – Tongsa district (Neylong?, 7km S of Shamgong, Tashiling, Tongsa); **Darjeeling** (Dumsong); **Sikkim** (unlocalised *Hooker* specimen). On emergent tree canopy of S-facing wet temperate forest; 1660–2400m. Fl. July–October; Fr. April.

GENERAL DISTRIBUTION. Nepal and India.

ETYMOLOGY. From the Latin *uni-* (single) and *-florus* (flowered).

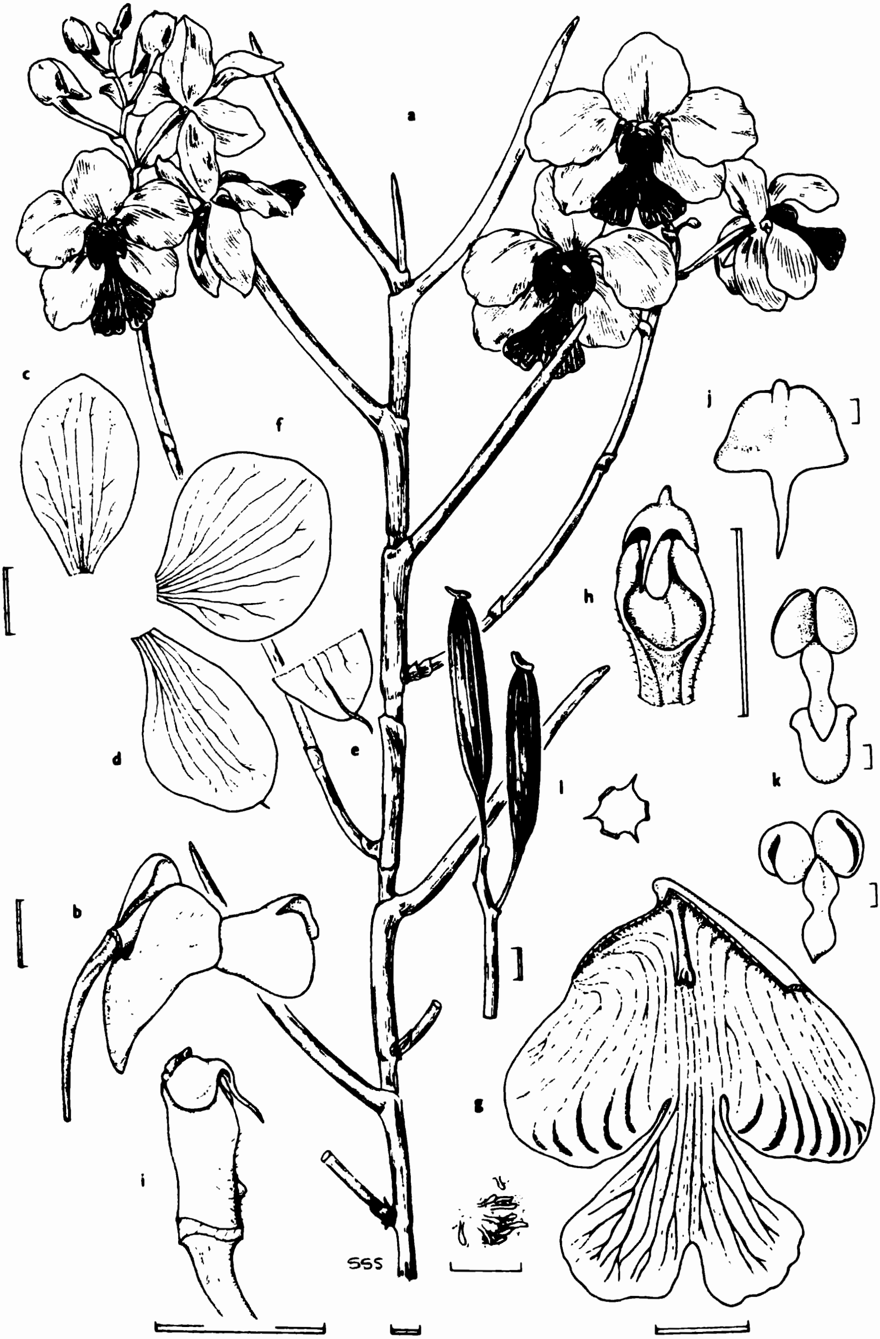

Fig 120 **Papilionanthe teres**. a, habit; b, lip, column and ovary; c, dorsal sepal; d, lateral sepal; e, lateral sepal (detail from behind); f, petal; g, lip (with detail of surface); h, column (front view); i, column (side view); j, anther cap; k, pollinarium (two views); l, fruit (with cross section). Drawn by Susanna Stuart-Smith from *Pantling* 45 (K).

4. P. vandarum (Rchb. f.) Garay in Bot. Mus. Leafl. 23(10): 372 (1974). Type without provenance, [icon. in] Bot. Mag. 83: t.4982 (1857)!
Aerides cylindricum sensu Hook. in Bot. Mag. 83: t.4982 (1857), non Lindl. (1832).
A. vandarum Rchb. f. in Gard. Chron. 1867: 997 (1867).

Plant forming large masses; *roots* long, flat, 6mm across. *Stem* pendent, branched, terete, flexuous, covered by leaf sheaths, to 60cm long; sheaths ridged, overlapping, tubular, 1.5–2.3cm long. *Leaves* suberect, terete, grooved, acuminate, jointed, 9–25 × 0.3cm. *Inflorescence* leaf-opposed, 1- to 4-flowered; peduncle short, sheathed, 2.2cm long; floral bracts triangular, 2–4 × 1.4–1.6mm. *Flowers* 3.8–5cm across, white with a purple-flushed base to the lip and spur, pedicel pink; pedicel and ovary 1.5–3.3cm long. *Dorsal sepal* obovate-oblong, obtuse, margins undulate, 2–3.6 × 0.8–1.5cm; *lateral sepals* similar, 3 × 1cm. *Petals* subrhombic, obtuse, reticulately veined, margins undulate, base twisted, 2–2.5 × 1.1–1.9cm. *Lip* 3-lobed, 2.2 × 2.2cm; lateral lobes erect, unequally bifid, flexuous, narrowly ovate, falcate, dentate on apical margin, 9 × 3mm; mid-lobe clawed, obovate, dilated and 2-lobulate at apex, 9 × 9mm (across apex); lobules orbicular 5 × 4mm; *spur* cylindric, base conical, straight, 1.8–2.5cm long. *Column* fleshy, 6mm long; column foot long; pollinia 1 × 1mm; anther cap 4mm across. *Fruit* obovoid, stalked; capsule 3.4–4 × 0.6–0.7cm. **Plate 30.**

Bhutan: C – Punakha (Tinlegang) and Mongar (near Lhuntse (M.F.B.)) districts; **Sikkim** (unlocalised *Hooker* specimen). 1600–1750m. Fl. May.

GENERAL DISTRIBUTION. NE India, Myanmar and S China.
ETYMOLOGY. From *Vanda* (an orchid genus) and the Latin suffix *-arius* (indicating a similarity) in reference to the flowers.

118. Phalaenopsis Bl.

Plants monopodial, epiphytic, medium-sized to large. *Stem* attenuate. *Leaves* few, oblong to elliptic. *Inflorescence* 1- to many-flowered, racemose or paniculate; peduncle long; rachis sometimes flattened. *Flowers* large to small, long-lasting, waxy. *Sepals* and *petals* similar, spreading, free; petals narrowed at base. *Lip* 3-lobed; lateral lobes erect; mid-lobe porrect; basal callus bifid or complex, sometimes extended into 2 recurved filiform tails. *Column* erect, expanded at apex; column foot short; rostellar projections and stipes long and slender; viscidium elliptic; pollinia 2.

The genus *Phalaenopsis* was established in 1825 by C.L. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. Christenson (2001) monographed the genus which comprises 40 to 45 species distributed from India to S China, Thailand, Indo-China, Malaysia and Indonesia to the Philippines and New Guinea.

The status of *Kingidium* has been the subject of dispute over the years. Rolfe (1917) proposed the name *Kingiella* as a segregate genus of *Doritis* to include five species, but Hunt (1970) rejected this name (a later homonym for *Kingiella* van Tiegheim (Loranthaceae)), and proposed instead the name *Kingidium*. Shim (1982) included *Kingidium* as a section of *Polychilos* Breda, while Christenson (1986) felt that *Kingidium*, based on the single character of a saccate labellum, did not warrant generic status and treated it as a section within *Phalaenopsis*. Seidenfaden (1988) argued for the maintenance of its generic status, a conclusion supported by Senghas (1990). Gruss & Röllke (1993, 1997) also treated *Kingidium* as a section of *Phalaenopsis*,but were mistaken in their choice of type, since it had been effectively lectotypified with *Aerides taenialis* by Hunt (1970).

Christenson (2001) has reviewed the position, considered molecular evidence, and concluded that it is no longer possible to maintain *Kingidium*. We follow this treatment here.

TYPE. *Phalaenopsis amabilis* (L.) Bl.; basionym: *Epidendrum amabile* L.
ETYMOLOGY. From the Greek *phalaena* (moth) and *-opsis* (indicating a resemblance), a reference to the resemblance of the flower of the type species, hence the common name of 'moth-orchids'.

Key to species

1. Lip spurred or saccate at base 2
+ Lip not spurred or saccate 4

2. Mid-lobe of lip as wide as long, apex truncate, emarginate or 2-lobed .... 1. **P. deliciosa** subsp. **hookeriana**
+ Mid-lobe of lip narrow, longer than wide, apex simple 3

3. Flowers yellow, green or green suffused with bronze; mid-lobe of lip boat-shaped .... 2. **P. braceana**
+ Flowers pink; mid-lobe of lip flat .... 3. **P. taenialis**

4. Mid-lobe of lip mobile; claw of lip adnate to column foot at a right-angle; sepals and petals white to creamy-white .... 4. **P. lobbii**
+ Mid-lobe of lip not mobile; claw of lip continuous with column foot; sepals and petals yellow to green, striped or blotched in maroon-red .... 5. **P. mannii**

Subgenus **Phalaenopsis**

Section **Deliciosae** E.A. Christenson in Indian Orchid J. 1(4): 152 (1985).

1. **P. deliciosa** Rchb. f. in Bonplandia 2: 93 (1854). Type without provenance, probably Java, Tjikoya, *Zollinger* 1492 (holo. W! no. 22218).

subsp. **hookeriana** (Gruss & Röllke) E.A. Christenson, Phalaenopsis, A Monograph: 223 (2001). Type: Myanmar (Burma), Moulmein, Tenasserim, *Parish* 175 (holo. K!). 140

Doritis wightii sensu Hook. f. in Ann. Roy. Bot. Gard. (Calcutta) 5: 39, t.59 (1895), non *Phalaenopsis wightii* Rchb. f.

Kingidium hookerianum Gruss & Röllke in Orchidee (Hamburg) 45(6): 230 (1994).

Plant forming clumps; *roots* caespitose, long, 2–5mm wide. *Stems* tufted, 0.3–1 × 0.3–0.8cm. *Leaves* few, obovate-oblong, obtuse to subacute, margins undulate, base narrowed, sessile, jointed, 7.5–15.5 × 2.1–4.9cm. *Inflorescence* basal, one to several, paniculate or racemose, 5- to 9-flowered; peduncle glabrous, 7–15cm tall; rachis 3–5cm long; floral bracts triangular, 0.5–1 × 0.3–0.5mm. *Flowers* 0.8–1.2cm across; sepals and petals pale yellow, lip white with purple striations and spotting; pedicel and ovary slender, 0.5–1cm long. *Dorsal sepal* narrowly elliptic, subobtuse, 6–9 × 1.6–3cm; *lateral sepals* broad, oblong-falcate, obtuse, 4–6 × 2–5mm. *Petals* elliptic, rounded, broadly clawed, 5–9 × 3–4mm. *Lip* spreading, 3-lobed, weakly saccate at base, 0.8–1.3 × 0.4–0.8cm; lateral lobes slightly spreading, broader above, wedge-shaped to obovate; mid-lobe obcordate, apex broad, deeply cleft, 4–6 × 4–6mm; disc with flattened callus, divided into 2 spreading teeth. *Column* elliptic. 1.5–2mm long. *Fruit* narrowly cylindric, 3–4 × 0.2–0.3cm.

Darjeeling (Ghose Nursery); **Sikkim** (Tista Valley). 500m. Fl. July–August.

GENERAL DISTRIBUTION. NE India.

ETYMOLOGY. Named in honour of Joseph Dalton Hooker (1817–1911) who collected plants extensively in Nepal and Sikkim and was author of the *Flora of British India*.

NOTES. *Kingidium hookerianum* was described by Gruss & Röllke in 1994, but Christeson (2001) reduced it to a subspecies of *P. delicosa*; it differs from the typical subspecies in having somewhat larger, yellow flowers. The name *D. wightii* Rchb. f. (which refers to a S Indian species) has been mistakenly used for plants of this yellow-flowered form exported from Kalimpong in the horticultural trade.

Subgenus **Aphyllae** (H.R. Sweet) E.A. Christenson, Phalaenopsis, A Monograph: 46 (2001).

2. **P. braceana** (Hook. f.) E.A. Christenson in Selbyana 9: 169 (1986). Type: Darjeeling/Bhutan, *Gamble's collectors* (holo. based on icon. Brace, CAL, iso. copy drawn by King, K!).
Doritis braceana Hook. f., Fl. Brit. India 6(1): 196 (1890).
Kingidium naviculare Z.H. Tsi ex Hashimoto, New Orchids 3: 40 (1984), *nom. invalid.*
K. braceanum (Hook. f.) Seidenfaden in Opera Bot. 95: 187 (1988).
Biermannia naviculare T. Tang & F.T. Wang ex Gruss & Röllke in Orchidee (Hamburg) 48(2): 56 (1997).
Type: China, Yunnan, *Forrest* 26706 (holo. K!).

Plant 14–17cm tall; *roots* numerous, long, flattened, 4–6mm wide. *Stem* sheathed, c.1.3cm long; sheaths brown, short. *Leaves* 1 or 2, linear-oblong, coriaceous, obtuse to subacute, 5–11 × 1.3–2.9cm. *Inflorescence* basal, erect, racemose, 8- to 10-flowered; peduncle thick, glabrous, sheathed, dark green speckled with red-brown; sheaths distant, triangular-ovate, acute, 3–3.5 × 1.3–1.5mm; rachis glabrous, 5–6cm long; floral bracts triangular, green, 2–3.5 × 1.3–1.5mm. *Flowers* pendent, 2.5–3cm across; sepals and petals yellow, green or greenish bronze with pink midrib, lip violet-purple; pedicel and ovary decurved, 1.5–1.8cm long. *Dorsal sepals* obovate-oblong, obtuse, 1–1.5 × 0.45–0.6mm; *lateral sepals* ovate-oblong, weakly falcate, 1.2–1.5 × 0.35–0.5mm. *Petals* obovate-oblong, obtuse, 1.2–1.5 × 0.4–0.5cm. *Lip* 3-lobed, spurred; hypochile 0.8–1cm long; lateral lobes ovate-lanceolate, subacute; epichile spathulate-obovate, rounded, boat-shaped, 6–7 × 2mm; disc with a forked callus; *spur* cylindric, straight, 1.5–3mm long. *Column* fleshy, 4–6 × 1.5–3mm (wide). *Fruit* cylindric, 5.5–8 × 0.3–0.4cm.

Darjeeling/Bhutan (unlocalised *Gamble's collector* specimen).

GENERAL DISTRIBUTION. ?NE India, China.
ETYMOLOGY. Named after Lewis Jones Knight Brace (1852–1938) Curator of the Herbarium of the Royal Botanic Garden, Calcutta between 1882 and 1886.
NOTES. Hooker (1890) described *Doritis braceana* basing the description on a drawing and description sent to him from Calcutta by Brace. He had seen no living material but felt that the species was distinct. King & Pantling (1898) treated it as conspecific with *D. taenialis*. Seidenfaden (1988) reviewed the position, having studied Chinese material of *Kingidium naviculare*, and proposed a new combination in *Kingidium*. The species is closely related to *P. taenialis* and though we have seen it in Yunnan, we have seen no material from Bhutan and further collections are required to determine its status in the region.

3. **P. taenialis** (Lindl.) E.A. Christenson & Pradhan in Selbyana 9: 168 (1986). Type: Nepal, unlocalised, *Wallich* s.n. (holo. BM!).
Aerides taeniale Lindl., Gen. Sp. Orchid. Pl.: 239 (1833).
A. carnosum Griff., Not. Pl. Asiat. 3: 365 (1851); Icon. Pl. Asiat. 3: t.338A (1851). Type: Bhutan, *Griffith* s.n. (holo. K-LINDL!).
Doritis taenialis (Lindl.) Hook. f., Fl. Brit. India 6(1): 31 (1890).
Kingiella taenialis (Lindl.) Rolfe in Orchid Rev. 25: 197 (1917).
Biermannia taenialis (Lindl.) T. Tang & F.T. Wang in Act. Phytotax. Sin. 1(1): 95 (1951).
Kingidium taeniale (Lindl.) P.F. Hunt in Kew Bull. 24: 98 (1970).
Polychilos taenialis (Lindl.) P.S. Shim in Malayan Nat. J. 36: 28 (1982).

Plant to 12cm tall; *roots* tufted, numerous, long, flattened, 3–5mm wide. *Leaves* usually 1–3, semi-deciduous, elliptic to elliptic-obovate, acute to subacute, sessile, jointed, 2.5–12 × 1–3.5cm. *Inflorescence* basal, pendent, racemose, 6- to 8-flowered; peduncle ridged, sheathed, 2–2.6cm long; sheaths distant, tubular at base, ovate, acute above, 2–2.5mm long; rachis ridged, glabrous, c.1.5cm long; floral bracts ovate-triangular, acute, 2–3 × 0.5–0.8cm. *Flowers* 1–1.5cm across; pale purple, pink to white (changing to pale green after fertilisation), lip epichile and anther purple; pedicel and ovary slender, curved, 0.9–1cm long. *Sepals* subequal, obtuse, 5-veined; *dorsal sepal* oblong-oblanceolate, 0.7–1 × 0.15–0.3cm; *lateral sepals* broadly elliptic, 0.6–1 × 0.3–0.4cm. *Petals* obovate, obtuse, 0.5–1 × 0.25–0.5cm. *Lip* adnate to the column foot; hypochile spurred below, with 2 long, narrowly oblong, falcate, backward-projecting lobes, 0.8–1cm long; epichile spathulate-oblong, entire, upper surface with a forked appendage, 6–9 × 2.5–3.5mm. *Column* narrowly winged, c.3mm long; *spur* cylindric-conical. *Fruit* narrowly cylindric, curved, 3.5–5.5 × 0.4–0.7cm. **Plate 30.**

Bhutan: C – Punakha (Punakha to Tinlegang, Samtengang to Chusom, Tashitang, Tinlegang, Wangdi Phodrang (field record)), Tongsa (Tashiling, Tongsa), Mongar (Drametse) and Tashigang (Lichan, Shali (M.F.B.), near Tashi Yangtsi) districts; **N** – Upper Kulong Chu district (near Tobrang (M.F.B.)); **Darjeeling** (Lopchu Tea Garden); **Sikkim** (Dentam to Pemyangtse, Rathang Chhu, Tendong, Thinglen, Yoksam). Low on tree trunks, in mixed broad-leaved riverine and montane forest, on W-facing slopes; 1000–2500m. Fl. April–May; Fr. May.

GENERAL DISTRIBUTION. India (Himalayas), Nepal, and China.

ETYMOLOGY. From the Latin *taenialis* (shaped like a tapeworm) in reference to the roots.

Subgenus **Parishianae** (H.R. Sweet) E.A. Christenson, Phalaenopsis, A Monograph: 63 (2001).

4. **P. lobbii** (Rchb. f.) H.R. Sweet, Genus Phalaenopsis: 53 (1980). Type: E Himalaya, cult. Veitch, coll. *Lobb* s.n. (holo. W! Herb. no. 22265).

Phalaenopsis parishii var. *lobbii* Rchb. f. in Saunders' Refug. Bot. 2: *sub* t.85 (1870).

P. listeri Berkeley in Gard. Chron. ser.3, 1: 280 (1887), *nom. nud.*

Polychilos lobbii (Rchb. f.) P.S. Shim in Malayan Nat. J. 36(1): 24 (1892).

42 Plant epiphytic, small; *roots* copious. *Stem* attenuate, enclosed by overlapping leaf sheaths. *Leaves* broadly elliptic, apex obliquely notched, 4.5–7 × 2.4–5cm. *Inflorescence* slender, suberect, laxly 3- to 6-flowered; floral bracts elliptic, obtuse, 1.5–2mm long. *Flowers* fleshy, several open simultaneously, 1.5–2cm across; sepals and petals creamy-white, mid-lobe of lip with two chestnut-rusty vertical bands, column white; pedicel and ovary slender, 1.5–2cm across. *Dorsal sepal* oblong-elliptic, obtuse, 0.8–1 × 0.4–0.5cm; *lateral sepals* obliquely ovate to suborbicular, 0.6–0.8 × 0.5–0.7cm. *Petals* obovate to subspathulate, obtuse to rounded, base cuneate, 6–8 × 3–4mm. Lip shortly clawed, adnate to the column foot, 3-lobed; lateral lobes erect, triangular, acute, fleshy, keeled, c.3 × 1mm; mid-lobe mobile, broadly triangular, fleshy, concave, apex rounded, base truncate, 0.4–0.6 × 0.8–1cm; appendage at base of mid-lobe semi-circular, fleshy, irregularly denticulate; disc with 4 filiform segments (at junction of mid- and lateral lobes). Column weakly curved, c.5mm long.

Darjeeling (unlocalised *Mann* specimen); **Sikkim** (unlocalised *Pantling* specimens). In tropical valleys. Fl. and Fr. May.

GENERAL DISTRIBUTION. NE India and Mayanmar.

ETYMOLOGY. Named after Thomas Lobb (1820–1894) who collected orchids in India for the Veitch Nursery, including the type of this species.

Subgenus **Polychilos** (Breda) E.A. Chritenson,
Phalaenopsis, A Monograph: 76 (2001).

5. **P. mannii** Rchb. f. in Gard. Chron. 1871: 902 (1871); Gard. Chron. n.s., 5: 503 (1876). Type: India, Upper Assam, *Mann* 10 (holo. W! Herb. no. 22269).

Phalaenopsis boxallii Rchb. f. in Gard. Chron. n.s. 19: 274 (1883). Type from the Philippines

Polychilos mannii (Rchb. f.) P.S. Shim in Malayan Nat. J. 36(1): 24 (1982).

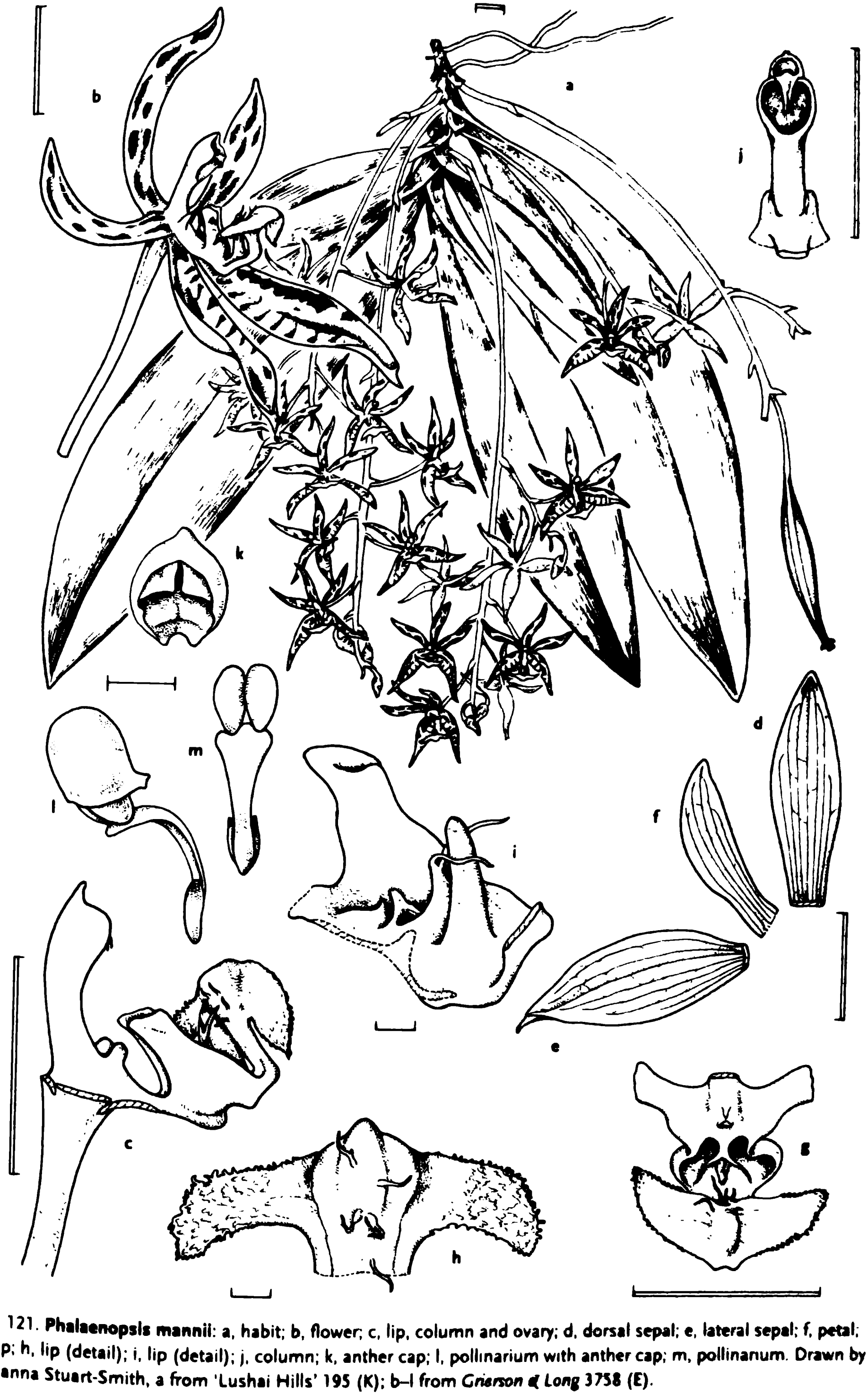

Fig. 121. **Phalaenopsis mannii**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip (detail); i, lip (detail); j, column; k, anther cap; l, pollinarium with anther cap; m, pollinarium. Drawn by Susanna Stuart-Smith, a from 'Lushai Hills' 195 (K); b–l from *Grierson & Long* 3758 (E).

Plant pendent, 20–35cm long; *roots* copious, long, flexuous, glabrous. *Stem* short, enclosed by overlapping leaf sheaths. *Leaves* 4 or 5, coriaceous, oblong-lanceolate to narrowly oblong, acute or obtuse, sessile, jointed, 9–37 × 2.5–7cm. *Inflorescence* 1 or 2, slender, pendent, racemose or paniculate, laxly 8- to 16-flowered; peduncle glabrous, tubular sheathed at base, 5–14cm long; rachis glabrous, 4–9cm long; floral bracts ovate-lanceolate, acute, convex, 0.6–1cm long. *Flowers* opening in succession, long-lasting, waxy, 2.5–3cm across; sepals and petals green to yellow with maroon-red blotches or striations, lip yellow to pale cream-white, column apex yellow; pedicel and ovary slender, 1.5–3cm long. *Dorsal sepal* obovate-oblanceolate, acute, margins revolute, dorsally keeled at apex, 2–2.4 × 0.7–0.8cm; *lateral sepals* obliquely ovate-elliptic, apex weakly falcate, acute, margins revolute, 2.2–2.5 × 0.9–1.1cm. *Petals* lanceolate to weakly falcate, acute, margins revolute, 1.7–2 × 0.5–0.6cm. *Lip* very fleshy, 3-lobed, shortly clawed, 0.9–1.1 × 1–1.1cm; lateral lobes subquadrate, apex obliquely truncate, with a central fleshy callus-like swelling; mid-lobe papillose on surface, apex transversely anchor-shaped, margin erose-dentate to lacerate,with a basal, semi-circular swelling; callus on mid-lobe apex ovoid, sparsely pilose; appendage over swelling pandurate, with 2 filiform tails, margin entire. Column cylindric, fleshy, weakly curved, c.8mm long, with 2 lateral protuberances at base. Fruit obovoid, ridged, c.5 × 1cm. **Fig. 121; Plate 30.**

Bhutan: (unlocalised *Grierson & Long* specimen); **Sikkim** (unlocalised *Mann* and *Pantling* specimens). In tropical valleys. Fl. and Fr. May.

GENERAL DISTRIBUTION. NE India, Myanmar and Vietnam.

ETYMOLOGY. Named after Gustav Mann (1836–1916) who collected the type specimen.

119. **Pomatocalpa** Breda

Plants small to medium-sized, epiphytic, monopodial. *Stems* to 40cm long. *Leaves* narrowly oblong, coriaceous. *Inflorescence* axillary, paniculate or racemose, many-flowered; peduncle long. *Flowers* small, non-resupinate. *Sepals* and *petals* similar, spreading, free. Lip fleshy, 3-lobed, spurred or saccate, with a tongue-like, often bifurcate callus projecting from the back wall. Column short, stout, lacking a foot; rostellum hamulate; pollinia 4, appearing as 2 unequal pollen masses; stipe long; viscidium small.

The genus *Pomatocalpa* was established in 1827 by J. Breda in his *Genera et Species Orchidearum et Asclepiadearum*. The history of the genus was outlined by Seidenfaden (1988). The delimitation of the genus is still uncertain, but there are about 40 species distributed in mainland Asia, Sri Lanka, China, Taiwan, Indo-China, Malaysia, Indonesia, the Philippines and New Guinea.

TYPE. *Pomatocalpa spicatum* Breda.

ETYMOLOGY. From the Greek *poma* (drinking cup) and *calpa* (pitcher), a reference to the urceolate lip.

Key to species

1. Leaves semi-terete; plants erect .... **1. P. armigerum**
+ Leaves flattened; plants pendent 2

2. Inflorescence branched 3
+ Inflorescence unbranched 4

3. Lateral lobes of lip caudate-acuminate .... **3. P. bhutanicum**
+ Lateral lobes of lip shortly truncate .... **4. P. spicatum**

4. Peduncle long; leaves linear-oblong, less than 1cm wide; sepals brown to buff coloured **2. P. bambusarum**
+ Peduncle short; leaves oblong, more than 1cm wide; sepals yellow .... **5. P. undulatum**

1. **P. armigerum** (King & Pantling) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 98 (1951). Type: India, Sikkim, *Pantling* 252 (holo. CAL, iso. BM! K! W!).
Cleisostoma armigerum King & Pantling in J. Asiat. Soc. Bengal. 65(2): 123 (1896).

Plant to 25cm tall; *roots* basal, clustered, tuberculate, 1–1.5mm wide. *Stem* erect, rigid, covered by leaf sheaths, 5–10cm long; sheaths tubular, irregularly ridged, 1–1.3cm long. *Leaves* distichous, fleshy, semi-terete, irregularly ridged, acute, sessile, jointed, 4–8 × 0.3–0.5cm. *Inflorescence* extra-axillary, subcapitate, densely many-flowered; peduncle short, sheathed; sheaths overlapping, ovate-lanceolate, apiculate, 2.5–3 × 1–1.4mm; floral bracts not seen. *Flowers* 6–7mm across, uniformly pale straw-coloured flushed with pink; pedicel and ovary slender, c.1.5mm long. *Dorsal sepal* spreading, ovate-orbicular, acute to apiculate, 3 × 1mm; *lateral sepals* spreading, similar, 3 × 1mm. *Petals* oblanceolate, acute, 1.5 × 0.5mm. *Lip* spurred, 3-lobed, 3mm long; lateral lobes erect, recurved, broadly triangular; mid-lobe ovate, obtuse, concave; spur widely saccate at base, interior with 2 calluses occluding the passage from front and back walls, 1.2 × 0.8mm; back wall callus curved, dilated upwards with 2 scale-like, upward-pointing teeth. *Column* adnate to lip, 0.6–1mm long; anther cap depressed; stipe 0.6mm long.

Sikkim (unlocalised *Pantling* specimen). In tropical valleys; 300–500m. Fl. September.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *armigera* (a female armour-bearer), probably a reference to the callus that closes, or guards, the entrance to the spur.
NOTE. Although King & Pantling (1898) stated that it was common at low elevations, the only specimens we have seen are the type collections.

2. **P. bambusarum** (King & Pantling) Garay in Bot. Mus. Leafl. 23(4): 190 (1972). Type: India, Darjeeling, Nimbong, *Pantling* 211 (holo. CAL, iso. K!).
Sarcanthus bambusarum King & Pantling in J. Asiat. Soc. Bengal 65(2): 123 (1896).
Cleisostoma bambusarum (King & Pantling) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 233, t.310 (1898).

Plant pendent, 5–13cm tall; *roots* basal, clustered, channelled, 1–2mm wide. *Stem* covered by leaf sheaths, 4–8mm long. *Leaves* fleshy, linear-oblong, channelled above, keeled beneath, acute, sessile, 4–7(–12) × 0.3–0.6(–0.8)mm. *Inflorescence* pendent, racemose, subdensely 10- to 12-flowered; peduncle slender, slightly ridged, glabrous, sheathed at base and above, 4.5–7.7cm long; sheaths broadly lanceolate, acute, prominently veined, 0.5–1 × 0.2–0.4cm; rachis thickened, narrowly winged, glabrous, 5cm long; floral bracts narrowly lanceolate, acute to acuminate, 2–4 × 0.5–1mm. *Flowers* 0.6–1.2cm across; dorsal sepal brown externally, flushed with yellow, buff-coloured internally, lateral sepals buff, lip buff with brown streaks on lateral lobes and a yellow patch on the mid-lobe; pedicel and ovary slightly flattened, 4–5mm long. *Dorsal sepal* suborbicular, concave, 3–5 × 1–1.5mm; *lateral sepals* broadly ovate, 5-veined, subacute, base broad, 3–4 × 2–3mm. *Petals* obovate-orbicular, clawed, 2–4 × 1–2mm. *Lip* 3-lobed, spurred, 2–3mm long; lateral lobes (at mouth of spur) short, subquadrate, erect; mid-lobe fleshy, triangular-ovate, acute, with a central swelling; spur wide, apex dilated-truncate, 2mm long; front wall callus thickened, back wall callus a slender plate resting on the front wall callus. *Column* with 2 short, fleshy arms, 0.6–1mm long. *Fruit* cylindric, curved, ridged, 1.8–2.5 × 0.3cm. **Fig. 122.**

Darjeeling (Nimbong); **Sikkim** (Rumtek). Epiphytic on bamboo (found growing on the nodes only, *fide* King & Pantling, 1898); 500m. Fl. May.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From *bambusa* (bamboo) and the Latin suffix *-arus* (indicating possession) in reference to the habitat.
NOTE. Ormerod (pers. comm.) considers that this species might belong in *Cleisostoma*.

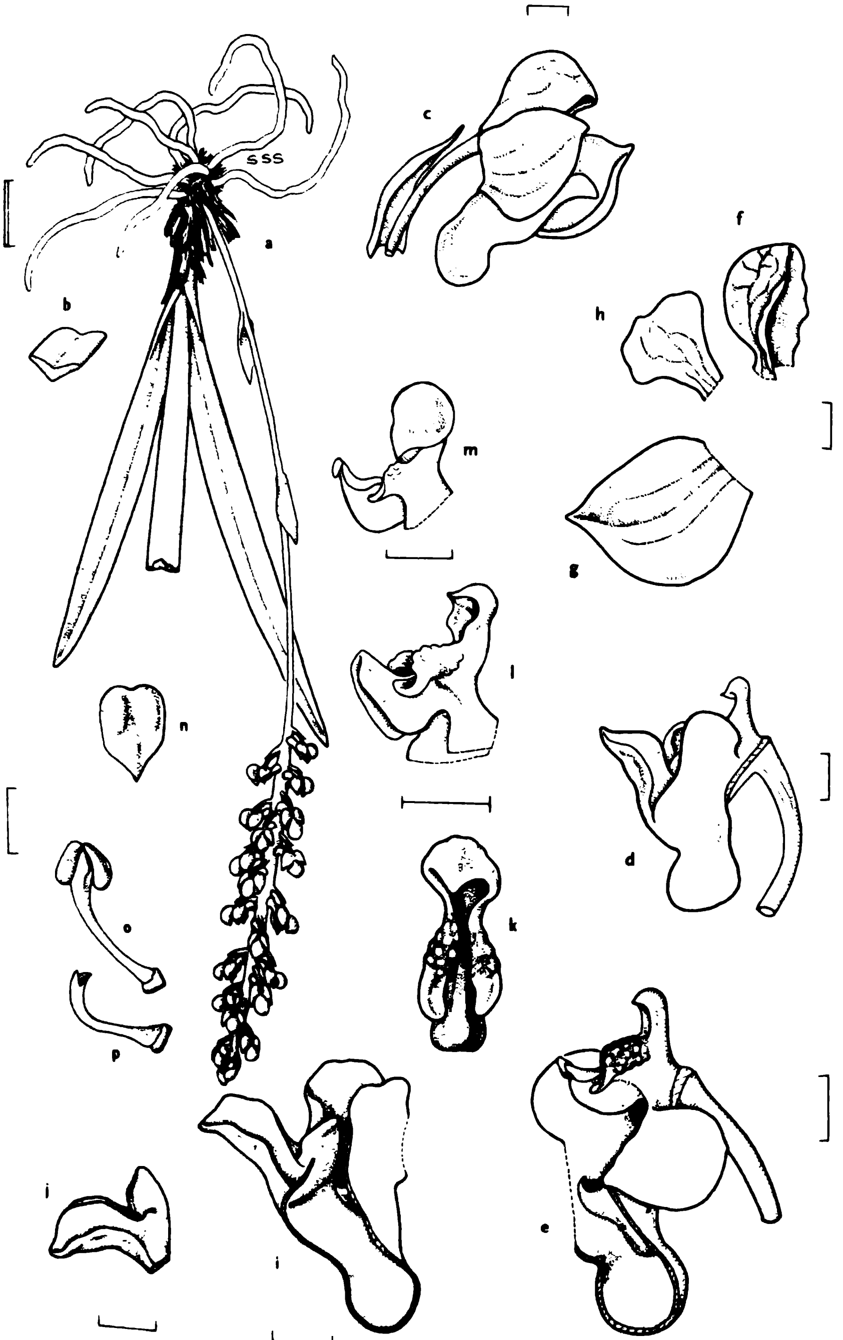

Fig 122 ***Pomatocalpa bambusarum*** a, habit, b, leaf (section), c, flower; d, lip, column and ovary; e, lip (sectioned), column and ovary; f, dorsal sepal, g, lateral sepal; h, petal; i, lip (sectioned); j, lip (detail); k, column (front view); l, column (side view), m, column apex with anther; n, anther cap, o, pollinarium; p, stipe and viscidium. Drawn by Susanna Stuart-Smith from *Pantling* 211 (K)

3. **P. bhutanicum** N.P. Balakrishnan in J. Bombay Nat. Hist. Soc. 75(1): 161, f.4 (1978). Type: E Bhutan, Tashiyangtsi, *Balakrishnan* 41993 (holo. CAL!, iso. ASSAM).

Roots spreading, c.2mm thick. *Stem* slender, covered by leaf sheaths, 6–7cm long; internodes short. *Leaves* spreading, distichous, equitant, linear-oblong, weakly falcate, narrowed and unequally 2-lobed at apex, jointed, 10–13 × 1–1.3cm. *Inflorescence* paniculate, arising from the dry leaf sheaths, erect at base, spreading above, 15- to 18-flowered; peduncle terete, sheathed at base, 8–10cm long; sheaths 1 or 2, scarious; floral bracts broadly triangular, acute, purple-green. *Flowers* 4–5mm across, non-resupinate; sepals yellowish-green, blotched with dark purple; pedicel and ovary c.5mm long. *Dorsal sepal* erect, concave, incurved, oblong, obtuse, c.3 × 1.2mm; *lateral sepals* concave, weakly falcate, incurved, ovate-oblong, obtuse, c.3 × 1.5mm. *Petals* narrowly oblong, obtuse, c.2 × 1mm. *Lip* distinctly 3-lobed, spurred, fleshy, 6–7mm long; lateral lobes incurved, concave, triangular, caudate-acuminate, c.1.5mm long; mid-lobe triangular, hastate, acute, c.2 × 1.5mm; disc 2-ridged; spur laterally compressed, dilated at base; back wall vertically lamellate, bifid at free margin; front wall narrowly vertically ridged. *Column* lacking a foot, with fleshy lateral lobes, c.1.5mm long; rostellum grooved, bidentate.

Bhutan: C – Tashigang district (Tashi Yangtsi). 1800m. Fl. June.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. From Bhutan, where the type collection was made.

NOTES. Balakrishnan (1978) stated that his species was closely allied to *P. ramosum* (Lindl.) Summerhayes but differed in that the sepals were shorter than the spur, the lateral lobes of the lip longer and acuminate, the mid-lobe of the lip sagittate and acute, and the disc and spur glabrous. Seidenfaden (1988) doubted that this species belonged to the genus *Pomatocalpa* and Ormerod (pers. comm.) considers that it might be better placed in *Cleisostoma*.

4. **P. spicatum** Breda, Gen. Sp. Orchid. Asclep.: t.15 (1829). Type: Java, *Kuhl & van Hasselt* s.n. (holo. L, not found); Lectotype (selected here): [icon. in] Gen. Sp. Orchid. Asclep.: t.15 (1829)!
Cleisostoma wendlandorum Rchb. f. in Allg. Gartenzeitung 24: 219 (1856), *nom. alt.*
C. uteriferum Hook. f., Fl. Brit. India 6(1): 74 (1890). Type from Malaysia (Perak).
Pomatocalpa wendlandorum (Rchb. f.) J.J. Smith, *loc. cit.* (1912).

Plant 13–25cm tall; roots basal, clustered. *Stem* thick, covered by leaf sheaths, 1.5–2cm long; sheaths overlapping, spreading, 1.5–3cm long. *Leaves* coriaceous, broadly oblong-elliptic to broadly obovate, unequally 2-lobed, lobules rounded, margins irreguarly undulate, sessile, jointed, 10–24 × 1.8–4cm. *Inflorescence* axillary, racemose or paniculate, densely many-flowered; peduncle stout, sheathed at base and above, 2–3cm long; sheaths ovate, acute, 1.5–2mm long; rachis 4–6cm long; floral bracts triangular, acute to apiculate, glandular-pubescent, 0.8–2mm long. *Flowers* 3–5mm across; sepals and petals pale yellow, marked with pink at base, lip white, the tongue yellowish with a purple flush and white-toothed edge, lateral lobes pale yellow (occasionally spotted); pedicel and ovary sparsely glandular-pubescent, 1–1.5mm long. *Dorsal sepal* obovate-elliptic, obtuse, 3.5–5.5 × 1.5–3mm; *lateral sepals* similar, incurved towards lip, 3.5–5 × 1–3mm. *Petals* obovate-elliptic, obtuse, base narrow, 3–4.5 × 1–2mm. *Lip* 3-lobed, spurred, 2–4mm long; lateral lobes short, truncate; mid-lobe short, fleshy, reniform; spur subglobose, transversely flattened, 1.5 × 1mm; front surface with 2 fleshy ridges, back wall tongued within. *Column* stout, bearing a semi-circular scale, 0.5–0.9mm long. *Fruit* cylindric, ridged, 1–1.3 × 0.25–0.35cm.

Bhutan: C – Punakha district (Neptengka); **Sikkim** (Tista Valley). In tropical valleys; 500–1660m. Fl. May–June; Fr. May–September.

GENERAL DISTRIBUTION. India, the Andaman Islands, Myanmar, China (Hainan), Thailand, Laos, Vietnam, Peninsular Malaysia, Sumatra, Java, Bali, Borneo and the Philippines.

ETYMOLOGY. From the Latin *spicatus* (with an elongate inflorescence).
NOTES. Seidenfaden (1988) discussed the taxonomy of this species and gave a thorough synonymy. The record for Bhutan is based on a poor Cooper specimen at BM which probably belongs to this species.

5. **P. undulatum** (Lindl.) T. Tang & F.T. Wang in Acta. Phytotax. Sin. 1(1–2): 100 (1951). Type: Bangladesh, Sylhet, coll. *F. De Silva, W. Gomez & H. Bruce* Wall. Cat. 7301 (holo. K-LINDL!, iso. K-W! K!).
Saccolabium undulatum Lindl. in Wall. Cat.: 7301 (1832), nom. nud.; Gen. Sp. Orchid. Pl.: 222 (1833).
Cleisostoma undulatum (Lindl.) Rchb. f. in Flora 55: 274 (1872).

Plant to 26cm tall; *roots* distant at base of stem, 0.8–1mm wide. *Stem* covered by leaf sheaths, 3–7cm long; sheaths overlapping, strongly veined, margins undulate, falcate, 1.5–2.5cm long. *Leaves* narrowly oblong to oblong-elliptic, apex obscurely 2-lobed, acuminate to obliquely obtuse, 8–17 × 1–2cm. *Inflorescence* racemose, emerging from within leaf sheath, 5- to 10-flowered; peduncle narrow, glabrous, sheathed, 1–1.5cm long; sheath cup-shaped, 0.5mm long; rachis glabrous, very narrowly winged, 5–9mm long; floral bracts triangular, 0.4–0.5mm long. *Flowers* 3mm across, yellow blotched with red; pedicel and ovary 3–5mm long. *Sepals* similar, ovate-oblong to elliptic, acute, 3-veined, 3 × 0.8mm. *Petals* narrowly spathulate-obovate, obtuse, 1-veined, 3 × 1mm. *Lip* spurred, 3-lobed, 1–2mm long; lateral lobes orbicular; mid-lobe suborbicular, obtuse; obscurely 3-lobed; spur oblong, weakly inflated to globose, contracted at mouth, membranous, 1.5mm long; back wall callus erect, bifid. *Column* 3-horned, 0.8mm long; rostellum minute, deflexed; stipe slender; viscidium minute. *Fruit* narrowly cylindric, ridged, 1–1.5 × 0.4–0.5cm.

Darjeeling (Rishep). 330m. Fl. March.

GENERAL DISTRIBUTION. Bangladesh and NE India.
ETYMOLOGY. From the Latin *undulatus* (wavy) in reference to the leaf margins.
NOTES. This poorly known species was originally described from Bangladesh. A specimen from Darjeeling (*Clarke* 13971, K) was identified by Hooker as *Sarcanthus undulatus* but the material is poor and lacks flowers. We have included it here, but have seen no other material from our area. Hegde (1984) listed it as occurring in Arunachal Pradesh.

Doubtfully recorded and imperfectly known species.

P. mannii (Rchb. f.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 105 (1912). Type: India, Assam, *G. Mann* 11 (holo. W! Herb. no. 53442).
Cleisostoma mannii Rchb. f. in Flora 55: 274 (1872).

NOTE. Reported by Bose & Bhattacharjee (1980) from Sikkim. We have seen no material from our area and tend to agree with Seidenfaden (1992) that it might be be conspecific with *P. spicatum*.

120. **Pteroceras** Hasskarl

Plants small, monopodial, epiphytic. *Stems* short. *Leaves* few to many, apex usually 2-lobed. *Inflorescence* few-to many-flowered. *Flowers* small, lasting one day. *Sepals* and *petals* free, spreading; lateral sepals often broader than petals, adnate to the column foot. *Lip* 3-lobed, fleshy, mobile, spurred; lateral lobes large; mid-lobe very short; spur porrect lacking interior ornaments. *Column* short, stout; foot long; rostellum projection oblong; stipe oblong; viscidium triangular; pollinia 2, deeply grooved; stipe broad.

The genus *Pteroceras* was established in 1842 by J. Hasskarl in his *Plantarum Genera et Species Novae aut Reformatae Javenses*. Pedersen (1993) monographed the genus and provided a thorough synonymy. The genus comprises 19 species distributed from India, Nepal, China, through SE Asia to the Philippines, Sumatra, Borneo and Java.

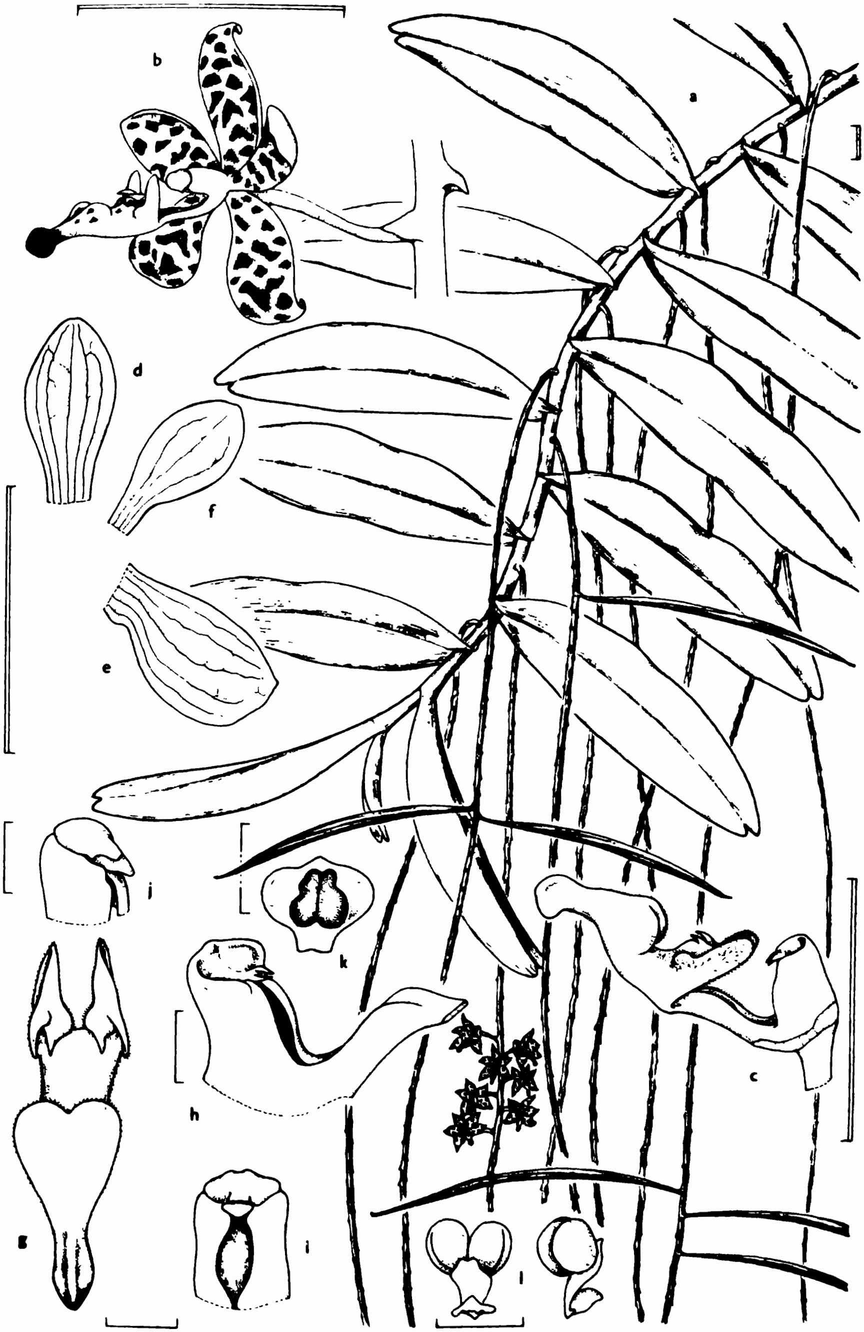

Fig. 123. **Pteroceras teres**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, column (side view); i, column apex; j, column apex (side view); k, anther cap; l, pollinarium (two views). Drawn by Susanna Stuart-Smith from *Lamb* 1163/89 (K).

TYPE. *Pteroceras teres* (Bl.) Holttum; basionym: *Dendrocolla teres* Bl..
ETYMOLOGY. From the Greek *ptero-* (feather, wing) and *ceras* (horn) in reference to the appendages at the base of the lip.

1. **P. teres** (Bl.) Holttum in Kew Bull. 14: 271 (1960). Type: Java, Buitenzorg, *Blume* 744 (holo. L! Herb. no. 903162691, iso. AMES!).
Dendrocolla teres Bl., Bijdr.: 289 (1825).
Aerides suaveolens Roxb., Fl. Ind. ed. 1832, 3: 473 (1832). Type: Bangladesh, Chittagong, *J. Roxburgh* s.n. (holo. not found); Lectotype: [icon. of] '*Aerides suaveolens*' Roxburgh 2350 (K!), designated by Seidenfaden in Opera Bot. 95: 256 (1988).
A. teres (Bl.) Lindl., Gen. Sp. Orchid. Pl.: 240 (1833).
Sarcochilus teres (Bl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 499 (1863).
Thrixspermum teres (Bl.) Rchb. f., Xenia. Orchid. 2: 121, t.140 (1867).
Sarcochilus suaveolens (Roxb.) Hook. f., Fl. Brit. India 6(1): 33 (1890).
Pteroceras suaveolens (Roxb.) Holttum in Kew Bull. 14: 271 (1960).
P. teres (Bl.) Bakhuizen in Blumea 12(1): 69 (1963), *isonym*
Saccolabium pumilio sensu Bhattacharaya in Bull. Bot. Soc. Bengal 23(2): 162, t.6 (1969), *non* Rchb. f.

Plant pendent. *Stem* horizontal to pendent, unbranched, 4–25 × 0.1–0.3cm; internodes covered by leaf sheaths, 0.3–2.3cm long. *Leaves* 4–17, borne on flowering shoot, linear-oblong to lanceolate, oblique, 2-lobed, sessile, jointed, 5–19 × 0.7–3.3cm. *Inflorescence* 1 (or 2–4 superposed); peduncle glabrous, 5- to many-flowered, bearing 1–4 small sheaths basally, 1.5–7.8 × 0.1–0.18cm; rachis terete, glabrous, dilated, nodes winged, 3.5–4.7cm long; floral bracts scale-like, semi-circular, glabrous, 0.6–2.1 × 1.2–5mm. *Flowers* resupinate, fragrant, 5–6mm long; sepals and petals yellow with reddish-brown spots or bars, lip yellow; pedicel and ovary terete, glabrous, 0.5–1 × 0.02–0.1cm. *Dorsal sepal*
550 spreading, obovate to elliptic, obtuse, 4.6–8 × 2.7–4.3mm; *lateral sepals* adnate to the column foot, obliquely obovate, truncate to rounded, 4.6–8 × 2.2–4.4mm. *Petals* narrowly obovate, obtuse, base shortly clawed, 4.4–7.8 × 1.8–3.4mm. *Lip* sessile, spurred, 3.2–5.7cm long; lateral lobes erect, linear-oblong to weakly falcate, 1.2–2.2 × 0.4–0.9mm; mid-lobe with a ridge-like callus above the spur entrance, surface rugose-papillose, 0.4–0.7mm long; calluses 2, small, bulb-like; spur cylindric, glabrous, apex bladder-like. *Column* subterete 1.2–2.5mm tall; foot 1.7–2.7mm long; pollinia deeply cleft, flattened; stipe 0.5–0.7 × 0.4mm. *Fruit* pendent, cylindric, 3.8–8 × 0.2–0.4cm. **Fig. 123.**

Duars (unlocalised *Haines* specimen); **Sikkim** (unlocalised *Pantling* specimen). In evergreen forest and tropical valleys. Fl. June.

GENERAL DISTRIBUTION. India, Nepal, Bangladesh, Myanmar, Thailand, Cambodia, Laos, Vietnam, the Philippines, Malaysia, Indonesia, Sulawesi and the Moluccas.
ETYMOLOGY. From the Latin *teres* (terete) in reference to the peduncle.

121. Rhynchostylis Bl.

Plants epiphytic. *Stems* short, thick. *Leaves* fleshy, long and narrow, channelled, apex unequally 2-lobed. *Inflorescence* lateral, pendent, racemose, densely many-flowered. *Flowers* resupinate. *Sepals and petals* similar, spreading, often purple spotted. *Lip* not hinged, adnate to the column foot, 3-lobed or simple, spurred; *spur* backward-pointing, laterally flattened. *Column* short; foot short; pollinia 2, cleft; stipe long, slender, widened at apex; viscidium ovate; rostellum long-pointed.

The genus *Rhynchostylus* was established in 1825 by Carl Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises three or four species widely distributed from Sri Lanka, India through SE Asia, China, the Philippines and south through Malaysia and Indonesia.

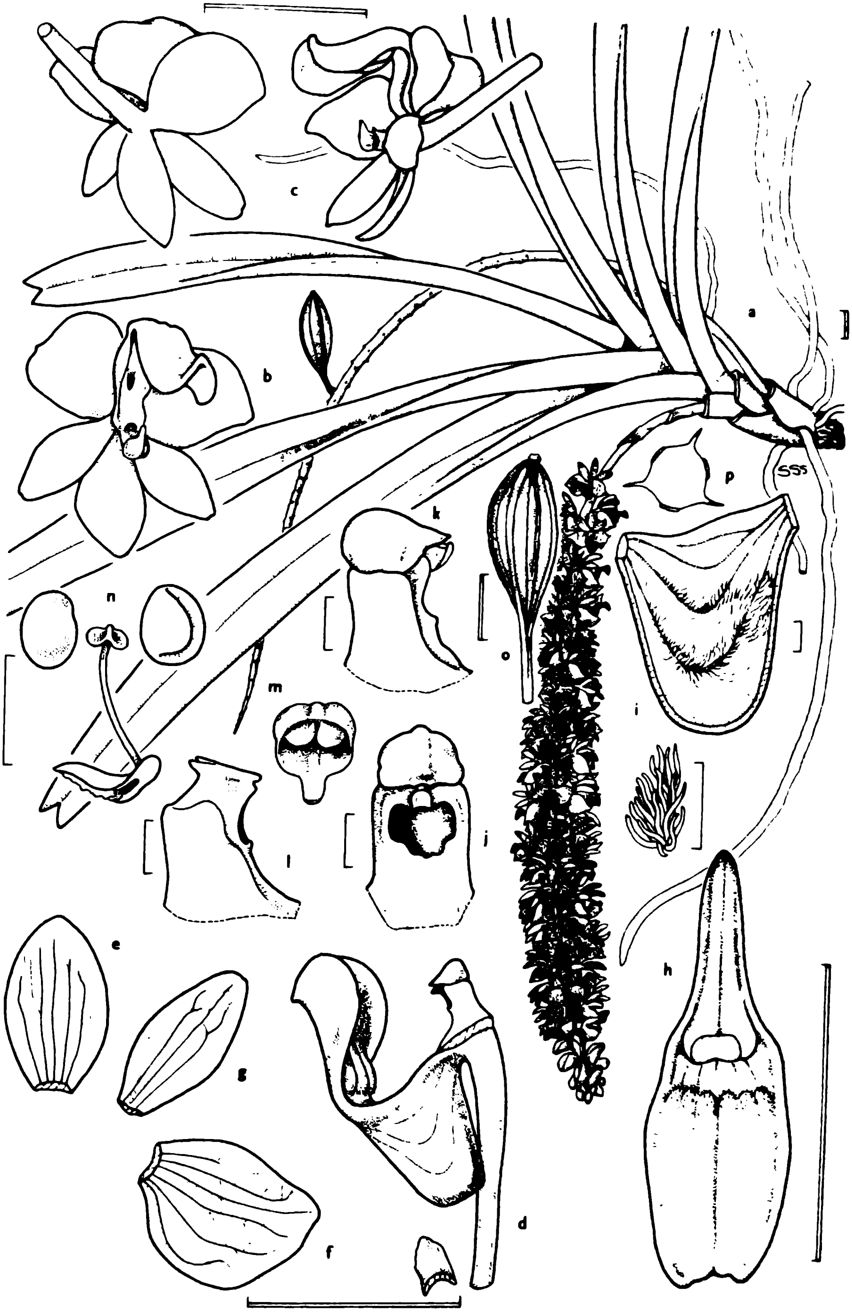

Fig. 124. **Rhynchostylis retusa**: a, habit; b, flower; c, flower (two views); d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, lip (sectioned with detail of hairs); j, column (front view); k, column (side view); l, column (side view with anther removed); m, anther cap; n, pollinarium; o, fruit; p, fruit (in section). Drawn by Susanna Stuart-Smith, a and o–p from *Koelz* 22584 (K); b–n from *Trudel* 584 (K).

TYPE. *Rhynchostylis retusa* (L.) Bl.; basionym: *Epidendrum retusum* L.
ETYMOLOGY. From the Greek *rhyncho-* (beak) and *stylis* (column) in reference to the beak-like column of the type species.

1. **R. retusa** (L.) Bl., Bijdr.: 286, t.49 (1825). Lectotype: India, Malabar coast, based on 'ansejeli-maravara' in Rheede, Hort. Malab. 12: t.1 (1693)!, designated by Majumdar & Bakshi in Taxon 28: 354 (1979).
Epidendrum retusum L., Sp. Pl. 2: 953 (1753).
Aerides undulatum J.E. Smith in Rees, Cycl. 39(Addenda) 39: Aerides, no.13 (1819). Type: India, Malabar & Coromandel, icon. Buchanan-Hamilton (holo. LINN).
A. spicatum D. Don, Prodr. Fl. Nepal.: 31 (1825). Types: Nepal, *Wallich* s.n. (syn. BM); *Buchanan-Hamilton* s.n. (syn. BM).
Epidendrum hippium Buchanan-Hamilton ex D. Don, Prodr. Fl. Nepal.: 32 (1825). Type: Nepal, *Buchanan-Hamilton* s.n. (holo. BM!, iso. LINN! Herb. no. 1404.28).
Sarcanthus guttatus Lindl. in Bot. Reg. 17: t.1443 (1831). Type: India, *Roxburgh* 811 (holo. BM!).

Plant pendent; *roots* grey, 0.6–1.2cm wide. *Stem* stout, covered by leaf sheaths, 10–30cm long; sheaths overlapping, 1.5–2cm long. *Leaves* distichous, spreading to arching, lorate, apex obliquely 2-lobed to retuse, coriaceous, deeply channelled, sessile, jointed, 11–35 × 1.2–3.5cm. *Inflorescence* emerging from leaf sheath, cylindric, densely many-flowered; peduncle 3-sheathed, 7–10cm long; rachis glabrous, 27–33cm long; floral bracts membranous, ovate, acute, 5–6 × 1.5–2mm. *Flowers* scentless, 1.7–2.3cm across; sepals and petals white with a few light purple dots, lip light purple, white at apex, spur white; pedicel and ovary 1–1.8cm long. *Dorsal sepal* spreading, broadly elliptic, obtuse, 0.8–1 × 0.6–0.65cm; *lateral sepals* spreading, obliquely ovate, obtuse, 7-veined, 0.9–1 × 0.7–0.8cm. *Petals* spreading, oblong-ovate, rounded, 5-veined, 0.9–1 × 0.4–0.5cm. *Lip* strongly saccate-spurred at base, adnate to the column foot, 1.1–1.2 × 0.7–0.8cm; epichile oblong-spathulate, apex rounded, apiculate (or slightly retuse); spur compressed, cylindric, obtuse to subtruncate, 6.5–8mm long. *Column* 3mm long, with a distinct foot; anther ovoid, beaked. *Fruit* ellipsoid, 6-ribbed, 1.6–2.5 × 0.7–1.1cm. **Fig. 124; Plate 30.**

Bhutan: C – Punakha (Wangdi Phodrang) and Tongsa (Berthi (M.F.B.)) districts; **Darjeeling** (Buxa Reserved Forest); **Darjeeling/Sikkim** (Great Rangit River); **Sikkim** (unlocalised *Hooker* and *Lacaita* specimens). On *Bauhinia malabarica* and *Gliricidia sepium* trees; 750–800m. Fl. May–July.

GENERAL DISTRIBUTION. Sri Lanka, India, Nepal, Myanmar, China, Thailand, the Philippines, Malaya, Sumatra, Java, Kangean Archipelago and ?Borneo.
ETYMOLOGY. From the Latin *retusus* (narrowly notched at the apex) in reference to the leaf.
NOTE. A full synonymy can be found in Seidenfaden (1988).

122. **Robiquetia** Gaudichaud

Plants epiphytic, medium-sized, monopodial. *Stem* pendent, long. *Leaves* oblong to elliptic, apex unequally 2-lobed. *Inflorescence* axillary, pendent, racemose or paniculate, many-flowered. *Flowers* small. *Sepals* and *petals* spreading. *Lip* immobile, 3-lobed; lateral lobes small, sometimes fleshy; spur apical, inflated, with callosities or scales within. *Column* short and stout, lacking a foot; stipes long, linear, spathulate, often hook-like; viscidium small; pollinia 2, grooved.

The genus *Robiquetia* was established in 1826 by Gaudichaud-Beaupré in Freycinet's *Voyage autour du Monde*. The genus comprises about 40 species distributed from the Himalayas to Australia and the south-west Pacific Islands.

A fuller synonymy can be found in Seidenfaden (1988).

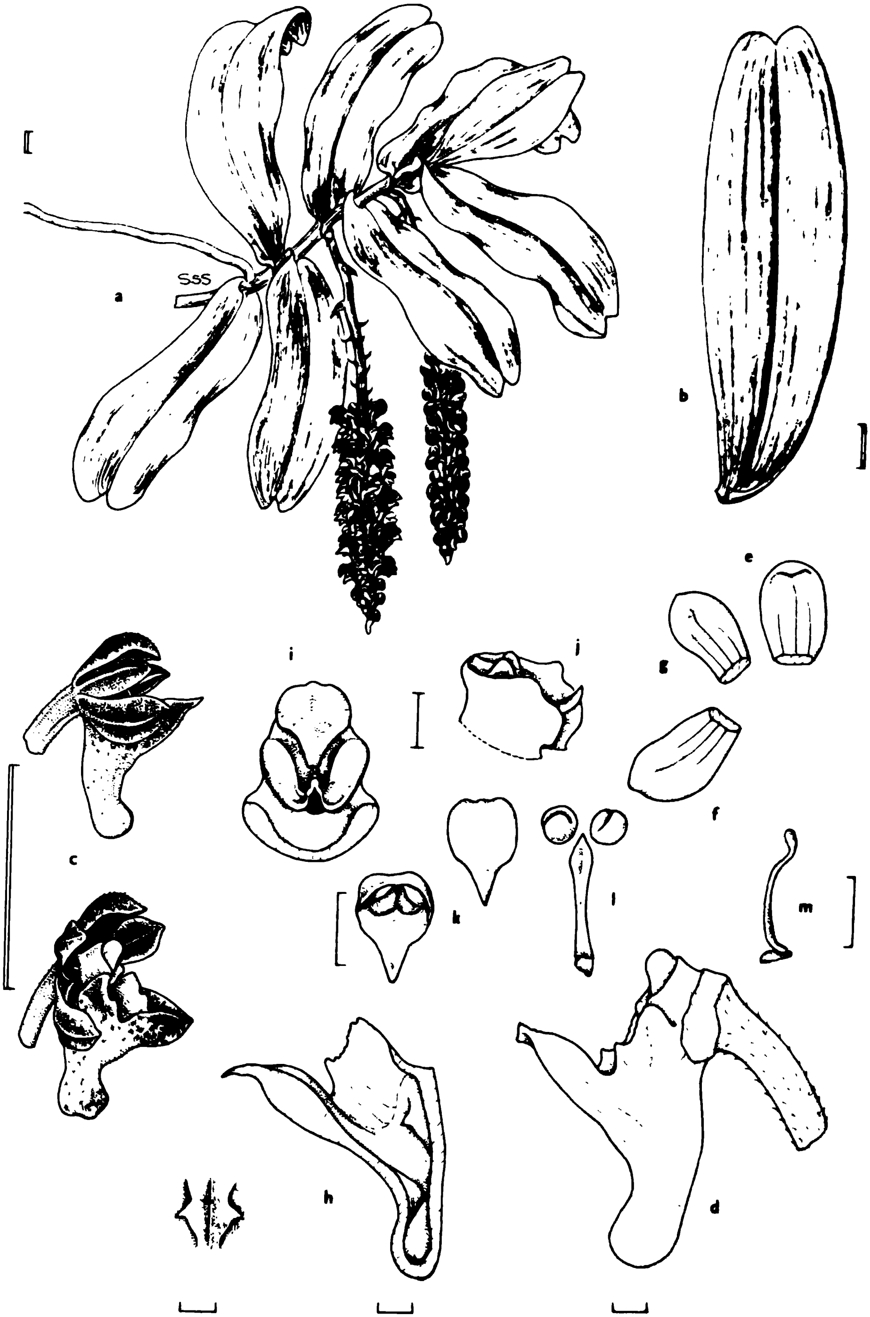

Fig. 125. **Robiquetia spatulata**: a, habit; b, leaf; c, flower (two views); d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip (sectioned, with detail of spur); i, column (front view); j, column (side view, with anther removed); k, anther (two views); l, pollinarium; m, stipe and viscidium. Drawn by Susanna Stuart-Smith, a from *Ross-Craig* s.n. (K); b–m from *Grierson & Long* 3603 (E).

TYPE. *Robiquetia ascendens* Gaudichaud.
ETYMOLOGY. Named in honour of Pierre Robiquet, a French chemist who made numerous important and useful chemical discoveries, including caffeine and morphine.

Key to species

1. Sepals and petals light yellow with large brown blotches, spur whitish; leaves more than 2.5cm wide .... **1. R. spatulata**
+ Sepals and petals yellow with small red-brown dots, spur dirty yellow; leaves less than 2.5cm wide .... **2. R. succisa**

1. R. spatulata (Bl.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 114 (1912). Types: Java, Pantjar, *Blume* 1929 (syn. L!, isosyn. K!); Java, *Blume* s.n. (syn. L!).
Cleisostoma spatulatum Bl., Bijdr.: 364 (1825).
Saccolabium densiflorum Lindl. in Wall. Cat.: 7311 (1832), *nom. nud.*; Gen. Sp. Orchid. Pl.: 220 (1833). Types: Bangladesh, coll. F. *De Silva* Wall. Cat. 7311A (syn. K-LINDL!, isosyn. K-W!); Malaysia, Penang, coll. G. *Porter* Wall. Cat. 7311B (syn. K-LINDL!, isosyn. K-W!).
Sarcanthus densiflorus (Lindl.) Parish & Rchb. f. in Trans. Linn. Soc. London 30: 136 (1874).
Gastrochilus densiflorus (Lindl.) Kuntze, Revis. Gen. Pl. 2: 661 (1891).

Plant to 1m long. *Stem* covered in leaf sheaths, 0.9–1.1cm thick; internodes 2.5–3cm long. *Leaves* broadly oblong-elliptic, apex unequally and broadly 2-lobed, narrowed to sessile, jointed base, 11–20 × 3.5–4cm. *Inflorescence* racemose, densely many-flowered; peduncle glabrous, sheathed at base and above, 3–8cm long; sheaths tubular, lanceolate-ovate, acute, 6–1.5 × 4–7mm; rachis 4–10cm long; floral bracts lanceolate, acute to acuminate, 4–5 × 1–2mm. *Flowers* 5–7mm across; sepals and petals yellow with dark purple-brown blotches, lip yellow with smaller spots, column white; pedicel and ovary glabrous, 3–5mm long. *Dorsal sepal* hooded, ovate, obtuse, 4–5 × 2–2.5mm; *lateral sepals* spreading, ovate, subacute, 4–5 × 1.5–2.5mm. *Petals* elliptic-ovate, subacute, revolute, 2–3 × 1–1.5mm. *Lip* 3-lobed, adnate to side of the column, spurred, 2–3cm across; lateral lobes narrow, margins erose-lacinate; mid-lobe fleshy, triangular-ovate to spathulate, apex acute; spur clavate, cleft, curved, interior callose, 4–5 × 1.5–2mm. *Column* broad, 1–2mm long. **Fig. 125; Plate 31.**

Bhutan: S – Sarbhang district (Singi Khola); **Sikkim** (Tista Valley). 330m. Fl. June.

GENERAL DISTRIBUTION. NE India, Myanmar, Thailand, Laos, Cambodia, Vietnam to Malaysia and Java.
ETYMOLOGY. From the Latin *spatulata* (spatula-shaped) in reference to the mid-lobe of the lip.

2. R. succisa (Lindl.) Seidenfaden & Garay in Bot. Tidsskr. 67: 119 (1972). Type: China, J.D. *Parks* s.n. (holo. probably lost); Lectotype (selected here): [icon. in] Bot. Reg. 12: t.1014 (1826)!
Sarcanthus succisus Lindl., in Bot. Reg. 12: t.1014 (1826).
Oecoclades paniculata Lindl., Gen. Sp. Orchid. Pl.: 236 (1833). Types: India, Assam, Gualpara, coll. *Buchanan-Hamilton* Wall. Cat. 7334A (syn. K-LINDL!, isosyn.K-W!); Bangladesh, Sylhet, coll. F. *De Silva* Wall. Cat. 7334B (syn. K-LINDL!, isosyn. K-W!).
Saccolabium parvulum Lindl. in J. Proc. Linn. Soc., Bot. 3: 36 (1859), *nom. nud.*
S. buccosum Rchb. f. in Gard. Chron. 1871: 938 (1871). Type: Myanmar (Burma), icon. Day (holo. K! [icon. in] J. Day, Drawings of Orchids 14: t.56 (1868)!).
Robiquetia paniculata (Lindl.) J.J. Smith in Bull. Jard. Bot. Buitenzorg ser.2, 9: 114 (1912).
Sarcanthus henryi Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 4: 77 (1919). Type: China, Yunnan, *Henry* 13582 (holo. B).

Plant pendent; *roots* from nodes, grey, 10–20cm long. *Stem* long, covered in leaf sheaths; internodes 1–2.2cm long. *Leaves* oblong-elliptic, apex broadly and unequally 2-lobed, tapered to sessile, jointed base, 5–8 × 1.2–2.4cm. *Inflorescence* paniculate, subdensely many-flowered; peduncle glabrous, sheathed, 8–12cm long; sheaths lanceolate-ovate, subacute, distant, 7–8mm long; rachis glabrous, 7.5–11cm long; floral bracts lanceolate, acute, 2–2.5 × 1–1.5mm. *Flowers* 7–9mm across, uniformly greenish-yellow to yellow, sometimes with minute red-brown dots; pedicel and ovary glabrous, 7–9mm long. *Dorsal sepal* hooded, ovate-elliptic, obtuse, 4–5 × 2.5–3mm; *lateral sepals* spreading, ovate, obtuse, 4–5 × 2.5–3mm. *Petals* obovate to wedge-shaped, obtuse, 3–4 × 2–2.5mm. *Lip* 3-lobed, spurred, slipper-shaped, 4–5mm long; lateral lobes spreading, rounded to truncate; mid-lobe narrowly oblong-ovate; spur clavate, cleft, straight to weakly curved, 3–4 × 1.3–1.7mm. *Column* prominently winged, 1–2mm long; stipe hamulate. *Fruit* cylindric-fusiform to obovoid, shortly stalked, 1.6–2.5 × 0.2–0.5cm.

Bhutan (Gheet Valley?); **Sikkim** (unlocalised *Pantling* specimens). In tropical valleys. Fl. May–June(–August).

GENERAL DISTRIBUTION. NE India, Myanmar, China (Yunnan, Hong Kong), Thailand, Laos, Cambodia and Vietnam.
ETYMOLOGY. From the Latin *succisus* (abruptly broken off) in reference to the leaf apex.

123. **Saccolabiopsis** J.J. Smith

Plants epiphytic, small. *Stem* pendent, short. *Leaves* oblong-elliptic, sessile, apex bifid. *Inflorescence* lateral, slender, racemose, laxly many-flowered. *Flowers* minute, thin-textured. *Sepals* and *petals* similar, gaping. *Lip* firmly adnate to the column base, saccate or spurred (with a wide opening); sac lacking appendages inside. *Column* small, cylindric, lacking a foot; pollinia 2, each divided into very unequal halves; stipe long, slender; viscidium disc-like.

The genus *Saccolabiopsis* was established in 1918 by J.J. Smith in *Bulletin du Jardin de Botanique de Buitenzorg*. The genus comprises about 12 species, widely distributed from the NW Himalaya to New Guinea and Australia.

TYPE. *Saccolabiopsis bakhuisenii* J.J. Smith.
ETYMOLOGY. From *Saccolabium* (a genus of orchid) and the Greek *-opsis* (indicating a resemblance).

1. **S. pusilla** (Lindl.) Seidenfaden & Garay in Bot. Tidsskr. 67: 118, t.33 (1972). Type: Bangladesh, Sylhet, coll. F. *De Silva* Wall. Cat. 7332A (holo. K-LINDL!).
Oeceoclades pusilla Lindl. in Wall. Cat.: 7332 (1832), nom. nud.; Gen. Sp. Orchid. Pl.: 237 (1833).
Saccolabium pusillum sensu (Lindl.) Lindl. ex Jackson, Index Kew. 2: 775 (1893), non Bl.
S. pumilio Rchb. f. in Walpers, Ann. Bot. Syst. 6: 886 (1864), nom. nud.
Gastrochilus pumilio (Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 661 (1891).
Pennilabium pumilio (Rchb. f.) Pradhan, Indian Orch.: Guide Identif. Cult. 2: 572 (1979).

Plant 6–8cm tall; *roots* clustered, basal, flattened. *Stem* covered with leaf sheaths, 1–3cm long; sheaths overlapping, 3–4mm long. *Leaves* 3, narrowly oblong-elliptic to narrowly obovate, curved, prominently veined beneath, apex unequally bifid, lobules oblong-triangular, sessile, jointed, sessile, 3–8.5 × 0.5–1.7cm. *Inflorescence* piercing leaf sheaths, racemose, laxly many-flowered; peduncle slender, glabrous, sheathed at base and above, 1.5–3cm long; sheaths lanceolate, acute, the upper 3 distant, 2.5–3.5mm long; rachis slender, glabrous, narrowly winged, 2–4mm long; floral bracts oblong, acute to obtuse, 1–1.5 × 0.2–0.4mm. *Flowers* membranous, 1.5–2.5mm across; sepals and petals cream, lip cream, purple at mouth of spur and on mid-lobe, column brownish-pink; pedicel and ovary sigmoid, glabrous, 3–4mm long. *Dorsal sepal* oblanceolate-oblong, obtuse, concave, 1-veined, arching over the column, 2–2.5 × 0.7–1mm; *lateral sepals* spreading, elliptic, obtuse, 1-veined, 2.3–2.6 × 1.3–1.5mm. *Petals* linear-oblanceolate, obtuse, 1-veined, dentate on one side, 1.2–1.5 × 0.4–0.5mm. *Lip* broadly 3-lobed, spurred, 2–3 × 1.5mm; hypochile with short, rounded lateral lobes; epichile broadly triangular, acute to obtuse, decurved; spur tapering, recurved, 2.5–3.5mm long. *Column* not winged,

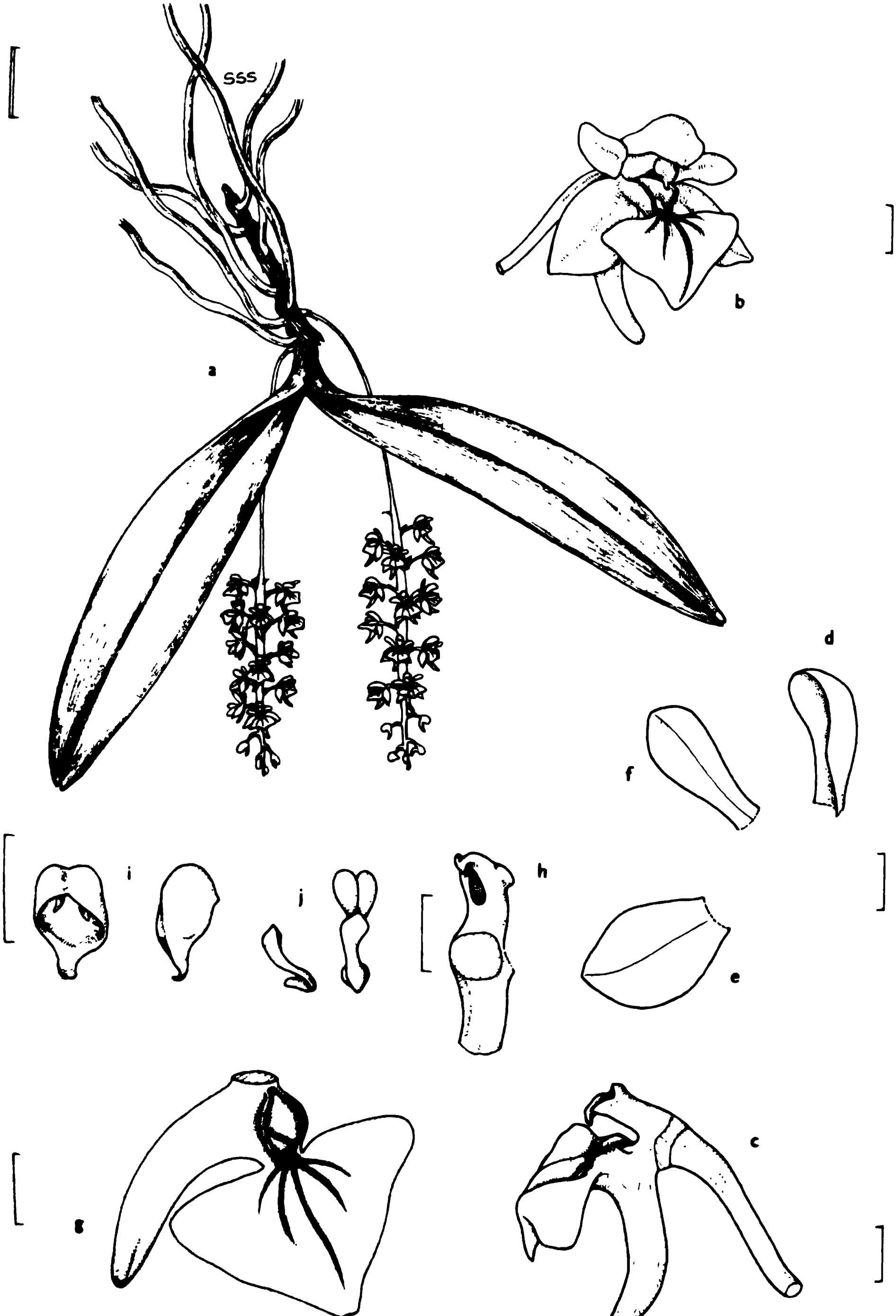

Fig. 126 **Saccolabiopsis pusilla**: a, habit; b, flower; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip and spur; h, column, i, anther cap (two views); j, stipe and viscidium, and pollinarium. Drawn by Susanna Suart-Smith from Pentling 112 (K).

1mm long; anther cap depressed, shortly beaked. Fruit cylindric, tapering, ribbed, 1.2–2.2 × 0.2–0.3cm. **Fig. 126; Plate 31.**

Bhutan: S – Sarbhang district (Burborte Khola, near Phipsoo); **Sikkim** (unlocalised Pantling specimen). In tropical valleys; on *Streblus asper*, ravine in subtropical forest; 290m. Fl. March–April.

GENERAL DISTRIBUTION. NE India, Myanmar and Thailand.
ETYMOLOGY. From the Latin *pusillus* (small) in reference to the habit.

124. Schoenorchis Reinwardt

Plants small, monopodial, epiphytic. *Stems* with condensed to elongate internodes. *Leaves* fleshy, flat to semi-terete. *Inflorescences* axillary, paniculate, many-flowered. *Flowers* usually not opening widely. *Sepals* free, dorsally keeled. *Petals* free. *Lip* spurred, fleshy, 3-lobed; spur lacking internal calluses. *Column* very short, lacking a foot; anther and rostellum long, pointed, geniculate; viscidium narrowly elliptic to ovate; pollinia 4, appearing as 2 unequal masses.

The genus *Schoenorchis* was established in 1825 by Caspar Reinwardt in Hornschuch's *Sylloge Plantarum Novarum*. There has, however, been some dispute about this since both Blume and Reinwardt independently described the genus in the same year. Garay (1972) gave priority to Blume, but Seidenfaden (1988) reviewed the situation and gave priority to Reinwardt and we follow this here. The genus comprises about 24 species (Christenson, 1985a) distributed in the Himalayas, India, Sri Lanka to China (Hainan) and the Philippines, south to Indonesia and east to New Guinea, Australia and the Pacific Islands.

LECTOTYPE. *Schoenorchis juncifolia* Bl.
ETYMOLOGY. From the Greek *schoeno-* (reed or rush) and *orchis* (orchid) in reference to the rush-like leaves.

1. S. gemmata (Lindl.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 100 (1912). Type: India, Khasia Hills, Gibson s.n. (holo. K probably lost). 557
Saccolabium gemmata Lindl. in Bot. Reg. 24: misc.50, no.88 (1838).
S. geminatum (Lindl.) Hook. f., Fl. Brit. India 6(1): 55 (1890), *err. typogr.*
Cleisostoma gemmatum (Lindl.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 234, t.313 (1898).

Plant pendent; *roots* basal. *Stems* curved, terete, leafy, covered by leaf sheaths, 8–30cm long; sheaths tubular, striate, 0.9–1.7cm long. *Leaves* distichous, linear-terete, fleshy, curved, channelled, apex unequally 2- to 3-lobed, base sheathing, jointed, 5–10 × 0.2–0.6cm. *Inflorescence* suberect to pendent, paniculate, laxly many-flowered; peduncle glabrous, sheathed, 2.5–4cm long; sheaths distant, lanceolate, adherent, annulate at base, 3–3.5mm long; rachis glabrous, 4–5.5cm long; floral bracts triangular, acute to acuminate, 1-veined, 0.9–1.4 × 0.7–0.9mm. *Flowers* 3–4mm long; sepals white to bright purple with white apices, petals bright purple, lip white with purple on the spur and lateral lobes; pedicel and ovary stout, 1.5–2mm long. *Dorsal sepal* ovate-oblong, acute, 1.5–2 × 0.5–1mm; *lateral sepals* ovate-elliptic, weakly falcate, 1.5–2 × 0.5–1mm. *Petals* obovate, obtuse to retuse, 0.9–1.2 × 0.5–0.7mm. *Lip* fleshy, obscurely 3-lobed, 1.5–2 × 1–1.5mm; lateral lobes erect, rounded; mid-lobe obovate, obtuse to rounded, fleshy, surface rugose; spur straight (parallel to ovary), swollen at apex, 1.2–2 × 0.5–0.6mm. *Column* fleshy, 2-horned at apex, 0.5–0.8mm tall; viscidium large. *Fruit* ovoid, ridged, shortly stalked, 3–4 × 2–2.3mm. **Fig. 127.**

Bhutan: S – Deothang district (Narfong (M.F.B.)); C – Punakha district (Bhotokha, Rimchu to Khosa); **Darjeeling/Sikkim** (Great Rangit River); **Sikkim** (Gangtok, Katong, Lachen Valley, between Mintok Khola and Paha Khola, Raiotgong, Rathgang Chhu, Thinglen, Tumlang). In montane forest; 830–2000m. Fl. May–June; Fr. May–October.

GENERAL DISTRIBUTION. Nepal, NE India, Myanmar, China, Thailand, Laos, Cambodia and Vietnam.
ETYMOLOGY. From the Latin *gemmatus* (jewelled) in reference to the brilliant flowers.

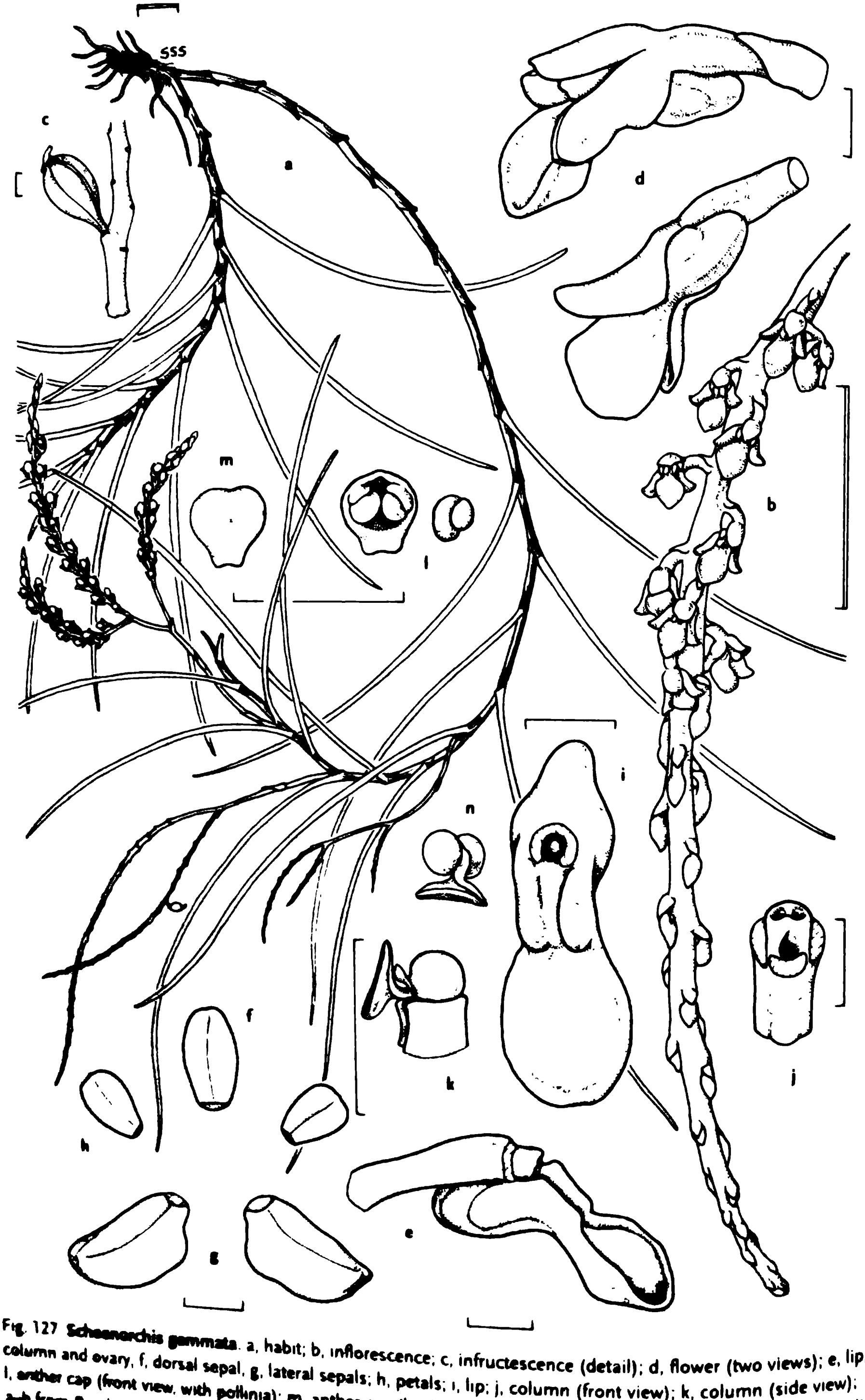

Fig. 127 ***Schoenorchis gemmata***. a, habit; b, inflorescence; c, infructescence (detail); d, flower (two views); e, lip, column and ovary, f, dorsal sepal, g, lateral sepals; h, petals; i, lip; j, column (front view); k, column (side view); l, anther cap (front view, with pollinia); m, anther cap (back view); n, pollinarium. Drawn by Susanna Stuart-Smith. a–b from *Pantling* 126 (K); c–n from *Seidenfaden* 8563 (K).

125. Smitinandia Holttum

Plants epiphytic, monopodial, medium-sized. *Leaves* narrow, distichous, distant. *Inflorescence* lateral, racemose, many-flowered. *Flowers* small, fleshy. *Lip* spurred, lacking ornaments; *spur* with mouth more or less closed by a high, fleshy, transverse wall at base of mid-lobe. *Column* short, cylindric, broadened at base, with a distinct foot; rostellum short; viscidium ovate; stipe short, widening upwards; pollinia 4, in unequal pairs.

The genus *Smitinandia* was established in 1969 by R.E. Holttum in the *Gardens' Bulletin, Singapore*. The genus is allied to *Acampe* and comprises three species distributed from India, Bhutan, Myanmar, SE Asia to Malaysia and Borneo.

TYPE. *Smitinandia micrantha* (Lindl.) Holttum; basionym: *Saccolabium micranthum* Lindl.
ETYMOLOGY. Named after Tem Smitinand, a forest engineer and botanist in Thailand who studied the orchids of Thailand with G. Seidenfaden.

1. **S. micrantha** (Lindl.) Holttum in Gard. Bull. Singapore 25: 106 (1969). Types: Nepal, Bhempedy (Bhimphedi), coll. *Wallich* Wall. Cat. 7300A (syn. K-LINDL!, isosyn. K-LINDL! K! K-W!); Bangladesh, Sylhet, coll. *F. De Silva* Wall. Cat. 7300B (syn. K-LINDL!, isosyn. K-W!).
Saccolabium micranthum Lindl., Gen. Sp. Orchid. Pl.: 220 (1833).
S. fissum Ridley in J. Linn. Soc., Bot. 32: 361 (1896). Type from Malaysia.
Gastrochilus parviflorus Kuntze, Revis. Gen. Pl. 2: 661 (1891), *nom. alt.*
Cleisostoma micranthum (Lindl.) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 234, t.312 (1898).
Uncifera albiflora Guillaumin in Bull. Soc. Bot. France 77: 333 (1930). Type from Cambodia.
Cleisostoma poilanei Gagnepain, *op. cit.* 79: 34 (1932). Type from Cambodia.
C. petitiana Guillaumin in Bull. Mus. Natl. Hist. Nat. sér.2, 17(5): 434 (1945). Type from Vietnam.
Ascocentrum micranthum (Lindl.) Holttum in Gard. Bull. Singapore 11: 275 (1947).
Pomatocalpa poilanei (Gagnepain) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 100 (1951).
Cleisostoma tixieri Guillaumin in Bull. Mus. Natl. Hist. Nat. sér.2, 32(4): 369 (1960). Type from Vietnam.

Plant to 25cm long; roots piercinging through leaf sheaths, long, 1–1.5mm wide. *Stem* compressed, stout, covered by leaf sheaths, 2.5–8cm long; sheaths overlapping, 0.7–1.2cm long. *Leaves* distichous, oblong, keeled, apex obliquely truncate to unequally 2-lobed, sessile, jointed, 1.3–8.5 × 1–2.1cm. *Inflorescence* leaf-opposed, arising from within leaf sheath, subdensely many-flowered; peduncle sheathed, ridged, 0.7–1.1cm long; sheaths ovate-lanceolate, 2.5–3mm long; rachis ridged, glabrous, 3.2–13cm long; floral bracts ovate to triangular, subacute to acute, 1.5–2mm long. *Flowers* few opening together, 3–4mm across; sepals and petals white with pink spots, lip pink-purple; pedicel and ovary slender, 2–3mm long. *Dorsal sepal* broadly ovate, obtuse, 3-veined, 1.5–2 × 1–1.5mm; *lateral sepals* similar, spreading. *Petals* spreading, oblong, obtuse, 1-veined, 1.5–2 × 0.8–1mm. *Lip* fleshy, 3-lobed, spurred, 2–3 × 1.5–1.9mm; lateral lobes small, triangular; mid-lobe convex, obtuse, erose, margins thin; *spur* 1.5–2.5 × 0.8–1mm, 2-callose inside, front wall callus larger than back wall callus. *Column* 0.5mm long, stout, lacking a foot, with 2 lateral swellings; anther cap depressed, beaked, 1mm wide; caudicle 0.5mm long. *Fruit* shortly stalked, 7–9 × 2.5–3.5mm. **Fig. 128; Plate 31.**

Bhutan: S – Samchi (Daina Khola, 10km W of Samchi) and Gaylegphug (Gaylegphug (M.F.B.)) districts; **Terai** (Sukna); **Darjeeling** (unlocalised *Cowan* specimen); **Sikkim** (unlocalised *Hooker* and *Pantling* specimens). In tropical and secondary forest in subtropical valleys; 270–1000m. Fl. March–May.

GENERAL DISTRIBUTION. India (Himalayas), Nepal, Myanmar, Thailand, Laos, Cambodia, Vietnam and Malaysia.
ETYMOLOGY. From the Greek *micro-* (small) and *anthos* (flower).

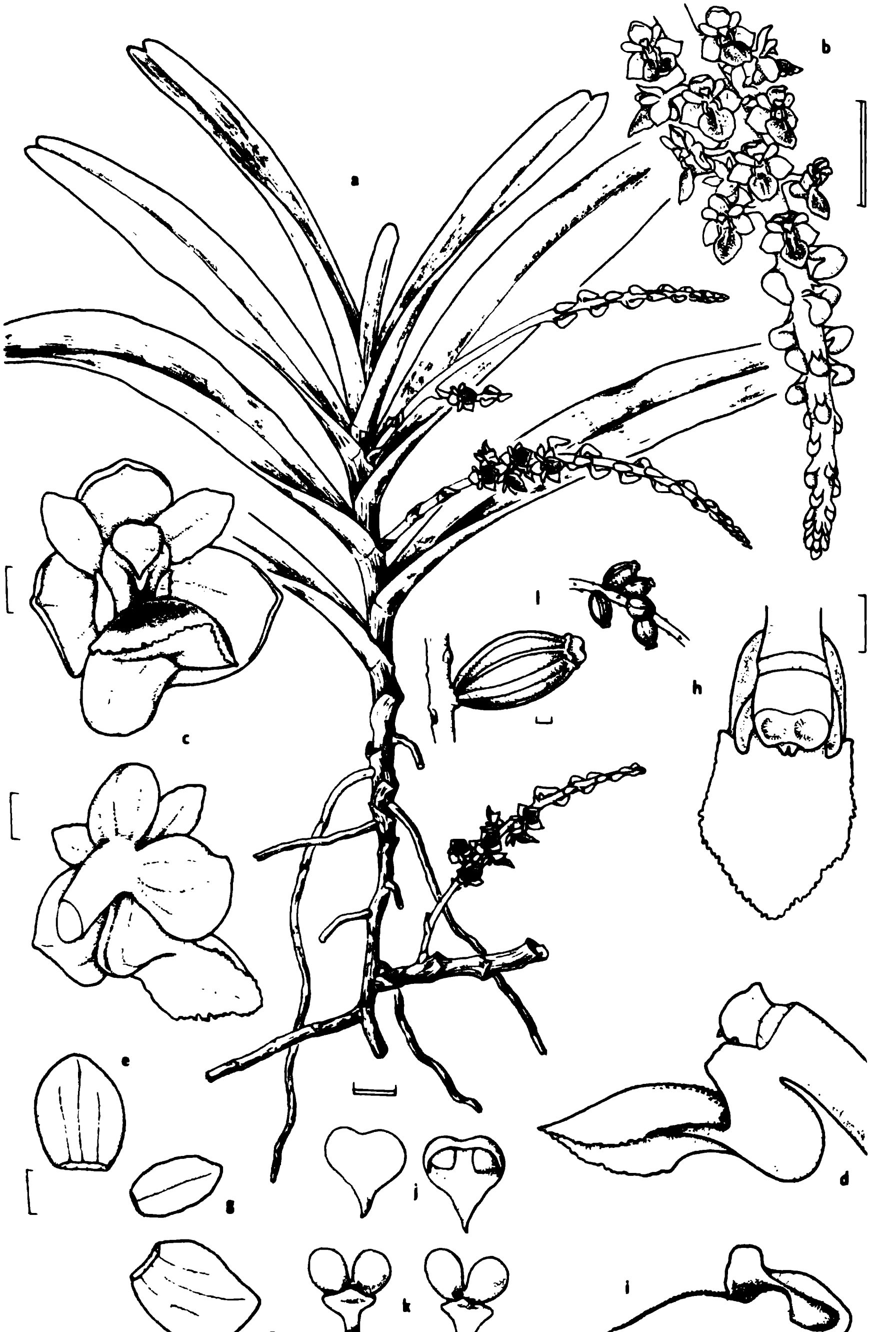

Fig. 128 ***Smitinandia micrantha***: a, habit; b, inflorescence; c, flower (two views); d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip and column; i, lip (sectioned); j, anther cap (two views); k, pollinarium (two views); l, infructescence (details). Drawn by Susanna Stuart-Smith, a and l from *Pantling* 78 (K); b–k from *Grierson & Long* 3338 (E)

126. **Staurochilus** Ridley ex Pfitzer

Plants epiphytic, monopodial. *Leaves* distichous, sessile. *Inflorescence* axillary, paniculate, many-branched; peduncle long. *Flowers* small to medium-sized. *Sepals* and *petals* spreading. *Lip* immobile, adnate to the column, spurred; *spur* pubescent within and at entrance. *Column* short; foot indistinct; pollinia 4, in unequal pairs; stipe narrow; viscidium ovate.

The genus *Staurochilus* was established in 1896 by H.N. Ridley in the *Journal of the Linnean Society* but without a generic description which was subsequently provided by Pfitzer in 1900. The genus is very closely related to *Trichoglottis* and their relationship is not finally resolved. Seidenfaden (1988) discussed this relationship and treated them as distinct genera, and we follow this treatment here. The genus comprises about 14 species distributed from India, through SE Asia to the Philippines and Indonesia.

TYPE. *Staurochilus fasciatus* (Rchb. f.) Ridley; basionym: *Trichoglottis fasciata* Rchb. f.
ETYMOLOGY. From the Greek *stauros* (cross) and *cheilos* (lip) in reference, perhaps, to the parallel lateral lobes of the lip that resemble a cross.

1. **S. ramosus** (Lindl.) Seidenfaden in Opera Bot. 95: 95 (1988). Type: Ganges Delta, icon. Wallich 654 (holo. K!).
Saccolabium ramosum Lindl., Gen. Sp. Orchid. Pl.: 224 (1833).
Aerides ramosum Wall., loc. cit. (1833), in *syn*.
Oecoclades flexuosa Lindl., Wall. Cat.: 7333 (1832), *nom. nud.*; Gen. Sp. Orchid. Pl.: 236 (1833). Type: Myanmar (Burma), Attran, coll. *Wallich* Wall. Cat. 7333 (holo. K-LINDL!, iso. K-W!).
Cleisostoma ramosum (Lindl.) Hook. f., Fl. Brit. India 6(1): 72 (1890).
Gastrochilus ramosus (Lindl.) Kuntze, Revis. Gen. Pl. 2: 661 (1891).
Sarcanthus ramosus (Lindl.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 92 (1912).
Pomatocalpa ramosum (Lindl.) Summerhayes in Kew Bull. 3: 56 (1948).
Trichoglottis ramosa (Lindl.) Senghas in Schltr., Orchideen ed.3, 1(21): 1315 (1988).

Plant to 40cm tall; *roots* basal, clustered, flattened, 2–3mm wide. *Stem* covered by leaf sheaths, 8–10cm long; sheaths overlapping, veined, 1.2–1.6cm long. *Leaves* oblong-lorate, curved, apex 2-lobed to erose, jointed, 13–20 × 1–1.6cm. *Inflorescence* laxly 5- to 16-flowered; peduncle slender, sheathed at base, 2–5.5cm long; sheaths tubular, 2–7mm long; rachis weakly zigzag; floral bracts ovate, subacute, 0.8–1 × 0.3–0.5mm. *Flowers* 6mm across; sepals and petals uniformly orange to pink sometimes barred centrally, yellow-green rimmed, lip white with yellow and pink markings; pedicel and ovary slender, 5–6mm long. *Dorsal sepal* obovate-oblong, rounded, 3 × 1.5mm; *lateral sepals* spreading, obovate, rounded to subacute, 2.5 × 1.3mm. *Petals* narrowly obovate, subacute, 2.5 × 1mm. *Lip* 3-lobed, spurred, 3–3.5mm long; lateral lobes subquadrate, pointed; mid-lobe broadly 3-lobed, broadly ovate, emarginate, pubescent and 2-callose at base; spur cylindric, curved, 1.5mm long, with a pubescent, raised tongue on back wall. *Column* pubescent, 1 × 1.2mm; anther cap shortly beaked; stipe long, slender. *Fruit* slender, cylindric, ridged, shortly stalked, 2.3–2.8 × 0.25–0.35cm. **Fig. 129.**

Sikkim (unlocalised *Hooker* specimen). In hot valleys. Fl. May.

GENERAL DISTRIBUTION. NE India, Myanmar and Thailand.
ETYMOLOGY. From the Latin *ramosus* (branched) in reference to the inflorescence.

127. **Stereochilus** Lindl.

Plants epiphytic, monopodial. *Leaves* coriaceous, sessile. *Inflorescence* axillary, racemose, lax. *Lateral sepals* adnate to base of the lip. Lip adnate to the column base, saccately spurred; *spur* with internal ornaments. Column erect, lacking a foot; rostellum long, linear; stipe clavate; viscidium small, ovate; pollinia 4, equal.

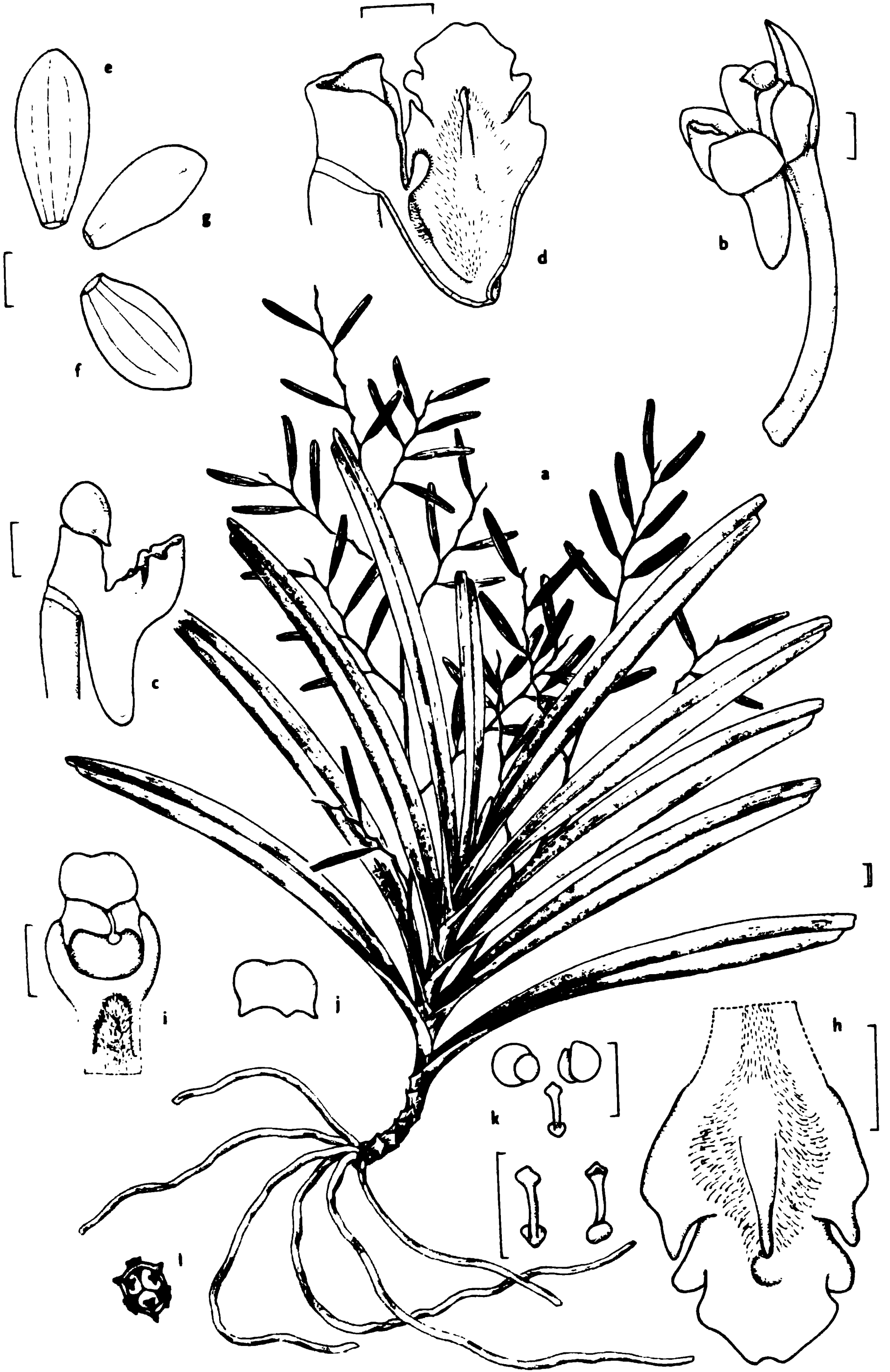

Fig. 129 **Staurochilus ramosus**: a, habit; b, flower; c, lip, column and ovary; d, lip, column and ovary (sectioned); e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, column; j, anther; k, pollinarium (details); l, fruit (sectioned). Drawn by Susanna Stuart-Smith, a from *Parish* 261 (K); b–k from *Hooker* s.n. (K); l from icon. Parish (K).

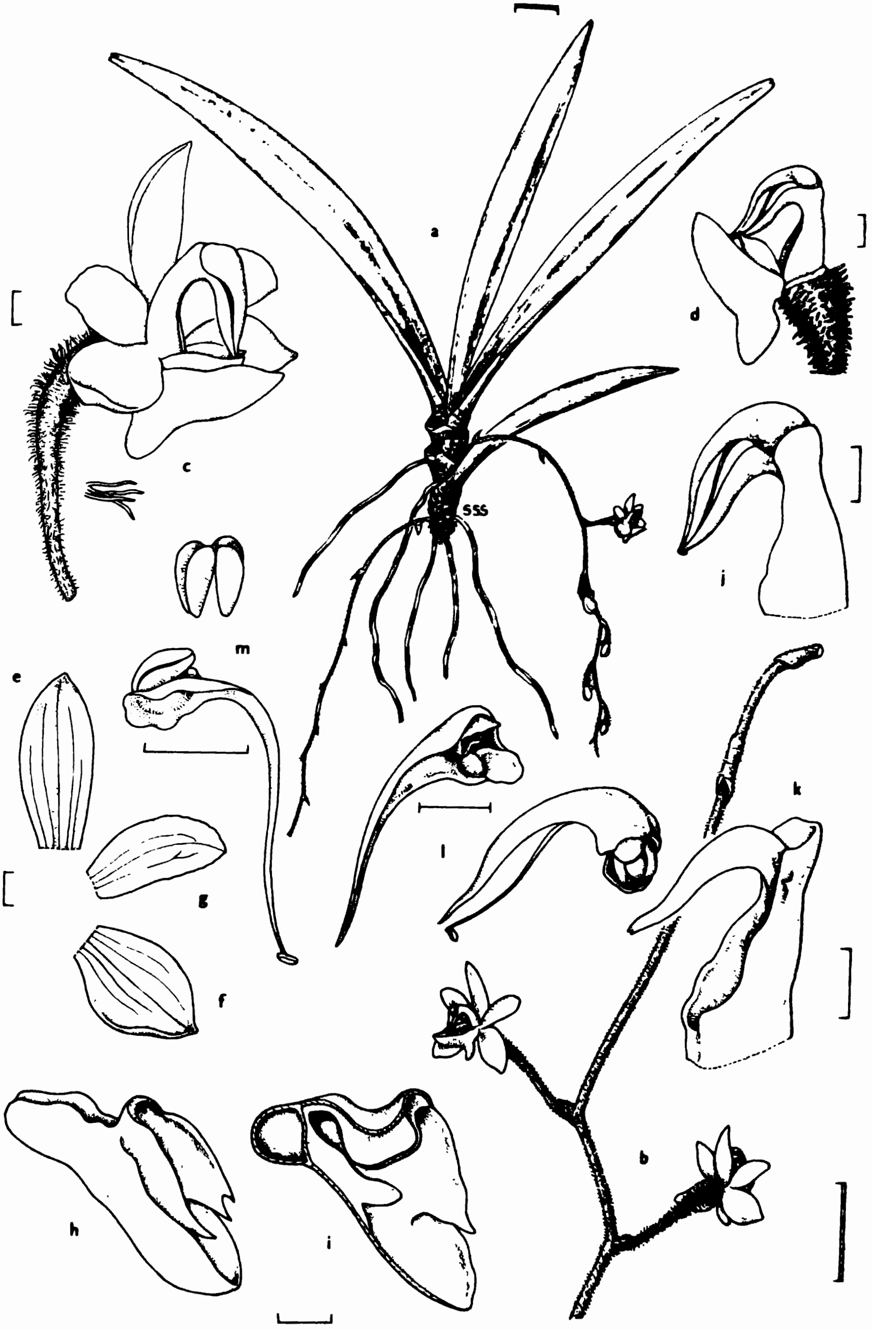

Fig. 130. **Stereochilus hirtus**: a, habit; b, inflorescence; c, flower and ovary (with details of hairs); d, lip, column and ovary; e, dorsal sepal; f, lateral sepal; g, petal; h, lip; i, lip (sectioned); j, column (side view); k, column (from side, with anther removed); l, anther (two views); m, pollinarium and pollinia. Drawn by Susanna Stuart-Smith from *Hooker* s.n. (K).

The genus *Stereochilus* was established in 1859 by John Lindley in the *Journal of the Proceedings of the Linnean Society* and is closely allied to *Cleisostoma*. The genus comprises five species distributed in NE India, Bhutan, Myanmar, China, Thailand and Vietnam.

TYPE. *Stereochilus hirtus* Lindl.
ETYMOLOGY. From the Greek *stereos* (solid) and *cheilos* (lip).

1. **S. hirtus** Lindl. in J. Proc. Linn. Soc., Bot. 3: 38 (1859). Type: India, Khasia, *Hooker* & *Thomson* 177 (holo. K-LINDL!).

Plant 8–10cm tall; *roots* slender, clustered towards base. *Stem* covered by leaf sheaths, 1–1.5cm long; sheaths wrinkled, 7–9mm long. *Leaves* fleshy, semi-terete, linear-oblong, apex minutely bifid to subacute, narrowed slightly towards base, jointed, 5–11 × 0.5–0.8cm. *Inflorescence* decurved, laxly 5- to 9-flowered; peduncle slender, glandular-pubescent, sheathed, 3–5cm long; sheaths distant, ovate-lanceolate, acute, 2–3cm long; rachis glandular-pubescent, weakly zigzag, 3.5–9.5cm long; floral bracts lanceolate, acute to acuminate, pubescent, 3–3.5 × 0.8–1.3mm. *Flowers* glabrous, 0.8–1.1cm across; sepals and petals pink, lip white and pink, column white, anther purple; pedicel and ovary densely long-pubescent, 0.4–1.1cm long. *Dorsal sepal* spreading, ovate to oblong-lanceolate, obtuse, 5–6 × 1.5–2mm; *lateral sepals* spreading, ovate, obtuse, 4.5–5.5 × 1–3mm. *Petals* spreading, ovate to subspathulate, obtuse, margins crenate, 4–5 × 1.4–1.6mm. *Lip* adnate to the column base, 3-lobed, spurred, 4–5mm long; lateral lobes triangular, converging; mid-lobe oblong-ovate, obtuse, concave; *spur* widely conical, appressed to ovary, 2-callose at entrance, 1.5–2.5 × 1–1.5mm. *Column* dilated at base, 2.5–2.8mm tall; anther cap beaked; rostellum linear, decurved, 2–3mm long; stipe dilated towards apex, 3mm long; pollinia 0.6–0.7mm across. **Fig. 130.**

Sikkim (Tendong). 660m. Fl. June.

GENERAL DISTRIBUTION. NE India and Myanmar.
ETYMOLOGY. From the Latin *hirtus* (hairy) in reference to the pedicel and ovary.

128. Taeniophyllum Bl.

Plants small, monopodial, epiphytic or lithophytic; *roots* long, spreading, flattened to terete, appressed, green, photosynthetic. *Leaves* absent or reduced to tiny brown scales. *Inflorescences* lateral; rachis slowly elongating, bearing flowers in succession, 1 or 2 at a time; floral bracts alternate. *Fowers* small. *Sepals* and *petals* free, widely spreading or connate at base and not opening widely. *Lip* attached to base of the column, spurred or saccate, entire to 3-lobed, often with an apical reflexed tooth or bristle. *Column* short and stout, lacking a foot; rostellar projection variable; viscidium narrowly ellipsoid to ovoid; pollinia 4, equal.

The genus *Taeniophyllum* was established in 1825 by C. Blume in his *Bijdragen tot der Flora van Nederlandsch Indië*. The genus comprises between 120 and 180 species distributed from tropical Africa through tropical Asia to Australia and the Pacific islands.

LECTOTYPE. *Taeniophyllum obtusum* Bl.
ETYMOLOGY. From the Greek *taenio-* (originally a hair band, but applied to the tapeworm) and *phyllon* (leaf) a reference to the flattened, leaf-like roots.

Key to species

1. Apex of lip broad, obtuse; sepals and petals free .... 1. **T. crepidiforme**
+ Apex of lip with a recurved spike-like process; sepals and petals connate at base 2. **T. retrospiculatum**

Section **Taeniophyllum**

1. **T. crepidiforme** (King & Pantling) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 245, t.324 (1898). Type: India, Sikkim, *Pantling* 193 (holo. CAL?).
Sarcochilus crepidiformis King & Pantling in J. Asiat. Soc. Bengal 64(3): 340 (1896).

Plant minute; *roots* relatively large, 1–2mm wide. *Inflorescence* erect; peduncle filiform, 8–9mm long; floral bracts minute, ovate. *Flowers* slightly open, 3–4mm long; sepals and petals greenish, lip white, stigma with purple margins; pedicel and ovary long, subsessile. *Dorsal sepal* ovate, obtuse, concave, incurved; *lateral sepals* similar, adnate to sides of the column. *Petals* lanceolate. *Lip* simple, sessile on the column, forming a roundish cup with entire edges, spurred; *spur* dilated, horizontal, pilose inside mouth. *Column* very short; anther slender, with a slightly deflexed, fleshy lip; pollinia 4, broadly ovoid. *Fruit* cylindric.

Sikkim (unlocalised *Pantling* specimen). Fl. September.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *crepidula* (a small shoe or slipper) and *forma* (shape) in reference to the lip base.
NOTES. Seidenfaden (1988) considered this species to be similar to, and perhaps conspecific with, *T. obtusum* Bl., but Rao & Lal (1991) concluded that they were distinct. We have seen no material of *T. crepidiforme* and the description is based on King & Pantling (1898), Pradhan (1979) and the protologue.

Section **Sepalocodon** Schltr. in Feddes Repert. Spec. Nov. Regni Veg. Beih. 1: 1009 (1913).

2. **T. retrospiculatum** (King & Pantling) King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 244, t.325 (1898). Type: India, Sikkim, *Pantling* 165 (holo. K!).
Sarcochilus retrospiculatum King & Pantling in J. Asiat. Soc. Bengal 64(3): 340 (1896).

Plant 1.5–3cm tall; roots 2–4.5mm wide. *Inflorescence* short, 1- or 2-flowered; peduncle slender, sheathed, glandular-pubescent, 1.5–2cm long; sheaths distant, lanceolate, acute, 0.9–1.3mm long; floral bracts lanceolate, acute, 0.7–0.9 × 0.3–0.4mm. *Flowers* opening singly, 2.8–4mm long, uniformly yellowish-green, transparent; pedicel and ovary 1.8–3mm long. *Dorsal sepal* spreading, linear-lanceolate, 2–3mm long, connivent with lateral sepals and petals at base to form a short tube; *lateral sepals* similar, adnate to sides of the lip at base, 1.8–2mm long. *Petals* spreading, linear-lanceolate, 1.4–3mm long. *Lip* simple, linear-lanceolate, spurred, 2–3mm long; base weakly gibbous; apex with an acutely recurved tooth; *spur* globose, opening of the mouth contracted, glabrous, c.0.75 × 0.75mm. *Column* 0.8mm long. *Fruit* cylindric, 1.1–1.2 × 0.2cm. **Fig. 131**.

Bhutan: S – Deothang district (N of Samdrup Jongkhar); **C** – Punakha district (Khosa, Rimchu); **Darjeeling** (Rayeng Valley). On mossy tree trunk in steep, moist, mixed *Pinus/Lithocarpus* forest; 1300–2400m. Fl. May–June.

GENERAL DISTRIBUTION. E Himalaya.
ETYMOLOGY. From the Latin *retro* (backwards) and *spicatus* (bearing a spike) in reference to the tooth on the lip apex.
NOTES. Seidenfaden (1988) considered this species to be closely related to, and perhaps conspecific with, *T. glandulosum* Bl. Rao & Lal (1991) concluded that *T. retrospiculatum* was distinct, differing from *T. glandulosum* in the basally connate lateral lip lobes, with the free portion 3- or 4-times longer than

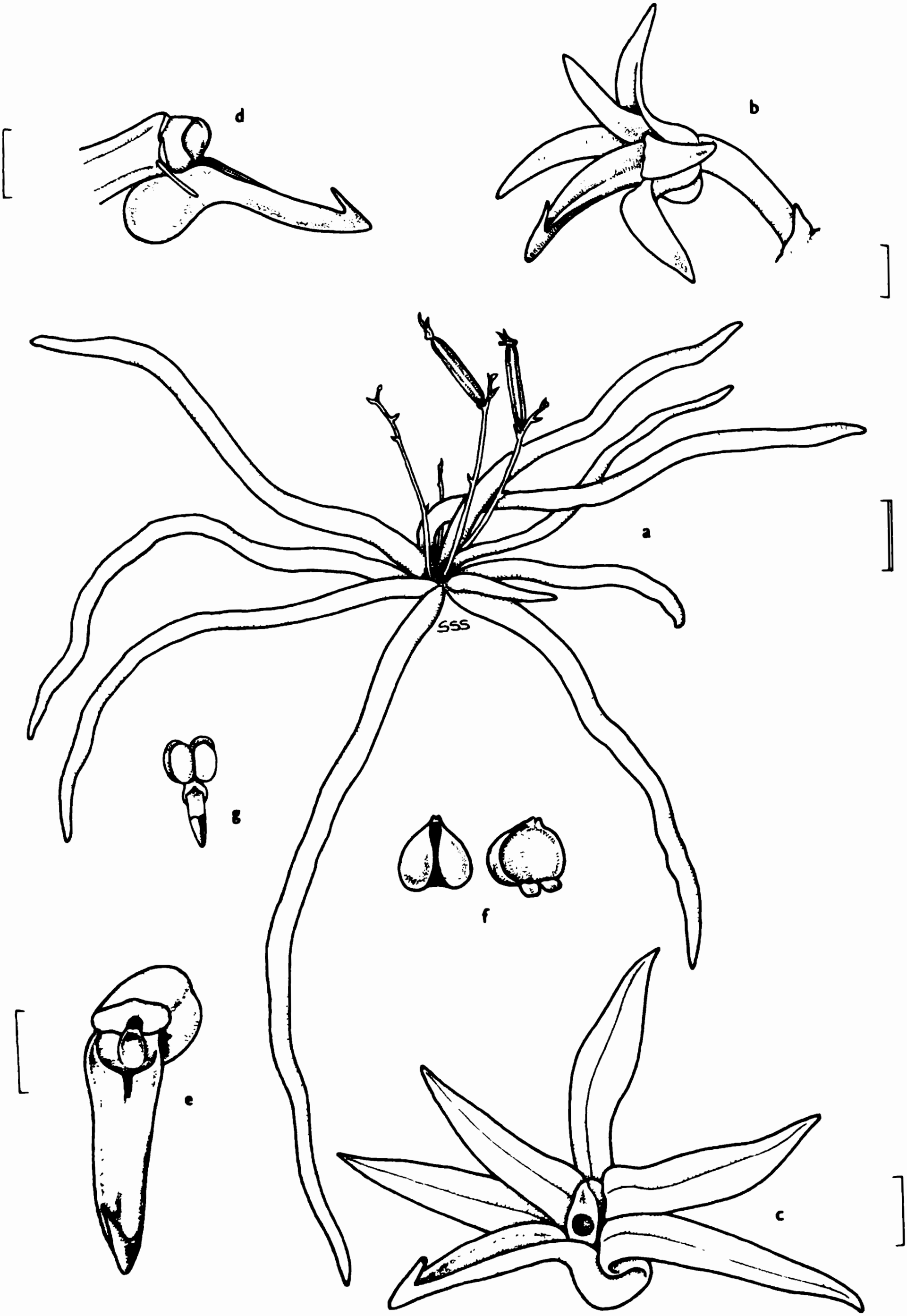

Fig. 131 **Taeniophyllum retrospiculatum**: a, habit; b, flower; c, flower (lip apex broken); d, lip, column and ovary (side view), e, lip and column, f, anther (two views), g, pollinarium. Drawn by Susanna Stuart-Smith, a and c from *Pantling* 165 (K), b d–g from t 325 in King & Pantling (1898).

(rather than equal to) the connate portion and the glabrous (rather than glandular) spur. Further collections are badly needed of this difficult species.

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

T. campanulatum Carr in Gard. Bull. Straits Settlem. 7: 68, t.8, f.A (1932). Type: Malaysia, Bukit Fraser, *Carr* s.n. (holo. BM).

NOTE. Reported from Diomarah in the W Kameng district of Arunachal Pradesh by Rao (1998b).

T. stella Carr in Gard. Bull. Straits Settlem. 7: 69, t.8, f.B (1932). Type: Malaysia, Pahang, Tembeling, *Carr* 294 (holo. BM, iso. K!).

NOTE. Reported from Doimarah in the W Kameng district of Arunachal Pradesh by Rao (1998b).

129. **Thrixspermum** Loureiro

Plants medium-sized, monopodial, epiphytic or terrestrial. *Stems* short to long. *Leaves* distichous, flattened, fleshy. *Inflorescence* axillary, racemose, short to long, flowers many (few opening together). *Flowers* ephemeral. *Sepals* and *petals* subequal. *Lip* immobile, 3-lobed, saccate but spurless; lateral lobes erect; mid-lobe usually fleshy; callus on front wall partly hairy or papillose. *Column* short and stout, sometimes winged; foot long; stipes short and broad; pollinia 4, as 2 unequal masses. *Fruit* long, slender.

The genus *Thrixspermum* was described in 1790 by João de Loureiro in his *Flora Cochinchinensis*. The genus comprises about 100 species distributed from Sri Lanka and the Himalayas east to the Pacific Islands.

The complex history of this genus was reviewed by Seidenfaden (1988), where a fuller synonymy can be found.

TYPE. *Thrixspermum centipeda* Loureiro.
ETYMOLOGY. From the Greek *thrix-* (hair) and *sperma* (seed).

Key to species

1. Plants erect; sepals linear-oblong, acuminate, more than 3cm long; floral bracts distichous **1. T. centipeda**
+ Plants pendent; sepals broadly ovate, acute, less than 1cm long; floral bracts not distichous **2. T. pygmaeum**

Section **Thrixspermum**

1. T. centipeda Loureiro, Fl. Cochinch.: 520 (1790). Type: Vietnam, Hué, *Loureiro* s.n. (holo. BM!).
Epidendrum complanatum König in Retzius, Observ. Bot. 6: 50 (1791). Type fromThailand.
E. thrixspermum Raeuschel, Nomencl. Bot. 3: 265 (1797), nom. alt.
Limodorum complanatum (König) Willdenow, Sp. Pl. ed.4(1): 126 (1805).
Aerides arachnites (Bl.) Lindl., Gen. Sp. Orchid. Pl.: 238 (1833).
Cleisostoma complanatum (König) Lindl. ex Steudel, Nomencl. Bot.: 378 (1840).
Sarcochilus arachnites (Bl.) Rchb. f. in Walpers, Ann. Bot. Syst. 6: 498 (1863).
Thrixspermum arachnites (Bl.) Rchb. f., Xenia Orchid. 2: 121 (1867).
Sarcochilus centipeda (Loureiro) Náves in Blanco, Fl. Filip., ed.3: 238 (1880).
S. complanatus (König) Hook. f., Fl. Brit. India 6(1): 41 p.p. (1890).
Thrixspermum complanatum (König) Schltr., in Orchis 5:55 (1911).

Plant epiphytic, erect; roots arising from nodes, worm-like, white-grey. *Stem* erect, elongate, covered by persistent leaf sheaths; internodes 1.5–2cm long. *Leaves* 6–8, coriaceous, linear-oblong, apex minutely bifid, jointed, 7–12 × 1.5–2.5cm. *Inflorescence* leaf-opposed; peduncle persistent, 1- or 2-sheathed, glabrous, 2–10cm long; basal sheath tubular, upper sheaths distant, lanceolate, acute, c.5 × 2mm; rachis laterally flattened, 2–13cm long; floral bracts persistent, distichous, broadly triangular, obtuse, bilaterally flattened, green-brown, 3–5 × 1.5–2mm. *Flowers* opening singly, c.2.5cm across, pale yellowish-white, lip spotted with red; pedicel and ovary filiform, 6–9mm long. *Sepals* similar, linear-oblong, acuminate, 3–3.5 × 0.1–0.15cm. *Petals* linear-oblong, acuminate, 3–3.2 × 1–1.6cm. *Lip* adnate to the column, 3-lobed, 6–7mm long; lateral lobes small, apices truncate, recurved; mid-lobe oblong, swollen, obtuse, puberulous; disc (between lateral lobes) with a fleshy callus; sac spur-like, wide. *Column* c.3mm long, base broad; foot short, broad. *Fruit* fusiform, 5.5–6.5 × 0.4–0.7cm. **Fig. 132.**

Duars (unlocalised *Pantling* specimen). 330m. Fl. September.

GENERAL DISTRIBUTION. India, Myanmar, China, Thailand, Laos, Cambodia, Vietnam, Malaysia, Sumatra, Java, Sulawesi and Borneo.

ETYMOLOGY. From the Latin *centipeda*, from a fanciful resemblance of the inflorescence to a centipede.

Section **Dendrocolla** (Bl.) J.J. Smith, Orch. Java 6: 577 (1905).

2. T. **pygmaeum** (King & Pantling) Holttum in Kew Bull. 14: 275 (1960), *in obs.* Type: Sikkim, Pemiongtsi (Pemayangtse), *Pantling* 472 (holo. CAL).

Sarcochilus pygmaeus King & Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 207, t.277 (1898).

568 Plant pendent, 2–3cm tall; roots worm-like, white-grey. *Stem* covered by leaf sheaths, 0.8–1cm long. *Leaves* 2–5, linear-oblong, acuminate, jointed, 2–7 × 0.3–0.9cm. *Inflorescence* distantly 2- or 3-flowered; peduncle slender, minutely sheathed, 1.6–1.9cm long; sheaths basal and distant, tubular-lanceolate, subacute, 1.5–2 × 0.6–1mm; floral bracts ovate, acute, 2–5 × 1.5–2mm. *Flowers* ephemeral, 7–8mm across, colour not known. *Sepals* similar, spreading, broadly ovate, acute, 4–5mm long. *Petals* spreading, narrowly oblong-lanceolate, obtuse, 2–3mm long. *Lip* adnate to the column foot, 3-lobed, 2–4mm long; lateral lobes erect, subtriangular, falcate, upper margins minutely crenulate, entire below; mid-lobe small, 2-lobed, base saccate; sac 2-lobed; callus on front wall of sac, keel pubescent. *Column* margins pubescent, c.1mm long; foot oblong.

Bhutan: C – Punakha district (Lobesa, Rimchu to Khosa); **Sikkim** (Pemayangtse). In N-facing *Pinus roxburghii* forest; 1300–2000m. Fl. April–May.

GENERAL DISTRIBUTION. Nepal and NE India.

ETYMOLOGY. From the Latin *pygmaeus* (dwarf).

Species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan.

T. **muscaeflorum** A.S. Rao & Joseph in Bull. Bot. Surv. India 11(1–2): 204 (1969). Type: India, Umsaw, Shillong, *Joseph* 45621 (holo. CAL, iso. ASSAM).

NOTES. Reported by Hegde (1995) from Namorah in the E Kameng district of Arunachal Pradesh. It differs from T. *pygmaeum* as follows: inflorescence longer than leaves, lateral lobes of lip short, lip callus rounded, tongue-like.

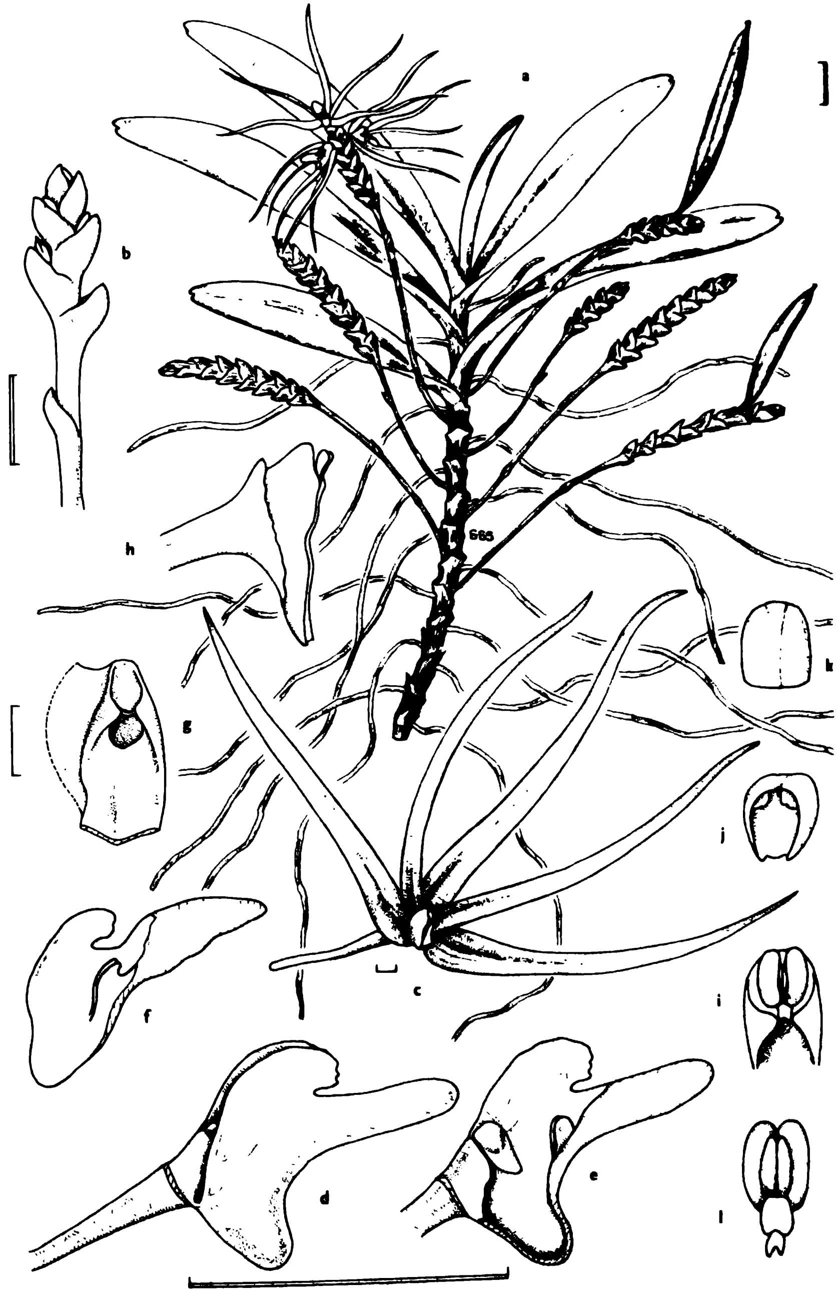

Fig. 132. **Thrixspermum centipeda**: a, habit; b, inflorescence; c, flower; d, lip, column and ovary (side view); e, lip (sectioned) and column; f, lip (detail, sectioned); g, column; h, column (side view); i, column apex; j, anther cap (front view); k, anther cap (back view); l, pollinarium. Drawn by Susanna Stuart-Smith, a from *Parish* s.n. (K); b from *Zhanhuo* 91-56 (K); c–e, and g from *Parish* 246 (K); f and h–l from icon. Parish (K).

130. **Uncifera** Lindl.

Plants epiphytic, pendent; *roots* piercing through leaf sheaths. *Stem* slender. *Leaves* overlapping, distichous. *Inflorescence* axillary, racemose. *Sepals* and *petals* similar. Lip simple, funnel shaped, spurred. *Column* terete, bent down over spur entrance; stipes long, linear, upper end winged, bent and hooked upwards, forming a roof over the pollinia; stipe wings borne on ridge formed by basal part of the long rostellum, backward turned; pollinia cleft, separated by a hyaline flange.

The genus *Uncifera* was established in 1859 by John Lindley in the *Journal of the Proceedings of the Linnean Society*. The genus comprises about six species distributed from the Himalayas through SE Asia to Vietnam.

TYPE. *Non designatus.*
ETYMOLOGY. From the Latin *uncus* (hook) and *-fer* (bearing) in renerence to the retrorse spur on the lip.

Key to species

1. Inflorescence exceeding leaves (14–16cm long); leaf apex 2-lobed .... **3. U. obtusifolia**
+ Inflorescence shorter than leaves (4–8cm long); leaf apex not 2-lobed 2

2. Lip 3-lobed; leaf sheaths less than 1cm long .... **1. U. acuminata**
+ Lip simple; leaf sheaths more than 2cm long .... **2. U. lancifolia**

1. U. acuminata Lindl. in J. Proc. Linn. Soc., Bot. 3: 40 (1859). Types: India, Assam, *Griffith* 18 (syn. K-LINDL!); Khasia, *Griffith* s.n. (syn. K-LINDL!); Khasia, *Hooker & Thomson* 193 (syn. K-LINDL!).
Saccolabium acuminatum (Lindl.) Hook. f., Icon. Pl. ser.4(22): t.2135 (1894).

Plant to 25cm long; *roots* c.1mm wide. *Stem* pendent, weakly zigzag, covered by leaf sheaths, 0.5–1cm long; sheaths overlapping, 0.8–1cm long. *Leaves* linear-oblong, oblong or oblong-lanceolate, acute to acuminate, narrowed to subsessile base, jointed, 2–9 × 0.4–1.2cm. *Inflorescence* leaf-opposed, piercing through leaf sheath, straight, subdensely many-flowered; peduncle glabrous, slender, sheathed, 3–4cm long; sheaths basal and at intervals above, ovate, acute, 3–4mm long; rachis 3–7cm long; floral bracts ovate-lanceolate, acute, 2–3 × 0.5–1mm. *Flowers* 5–8mm across, uniformly pale green, tips of petals and mid-lobe of lip white; pedicel and ovary slender, 3–4.5cm long. *Dorsal sepal* ovate-orbicular, concave, 3.5–5.5 × 2–2.8mm; *lateral sepals* similar. *Petals* broadly ovate, oblique, subtruncate, 3-veined, the veins terminating before the apex, 2.5–3.5 × 1.5–2.1mm. Lip 3-lobed, prominently spurred, 2–3mm long; lateral lobes large, rounded, erose; mid-lobe fleshy, broadly triangular; *spur* funnel shaped, strongly curved forwards, 6–8mm long. *Column* thick, c.2mm long; rostellum large; stipe 3mm long. *Fruit* narrowly cylindric, shortly stalked, 1.4–2.1 × 0.25–0.3cm.
Darjeeling (unlocalised *Gamble* specimen); **Sikkim** (unlocalised *Hooker* specimen). 1330–2000m. Fl. July–September.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *acuminatus* (with a long pointed tip) in reference to the leaf apex.

2. U. lancifolia (King & Pantling) Schltr., Orchideen ed.1: 583 (1914). Type: India, Darjeeling, Rississum, *Pantling* 152A (holo. CAL, iso. BM! K! L! LE! W!).
Saccolabium lancifolium King & Pantling in J. Asiat. Soc. Bengal 65(2): 122 (1896).

Plant pendent, to 28cm long. *Stem* weakly zigzag, covered by leaf sheaths, 14–28cm long; sheaths 2.2–2.5cm long. *Leaves* linear-lanceolate, apex acute to aristate, base narrowed and subsessile, jointed, 6–10 × 0.7–1.1cm. *Inflorescence* leaf-opposed, densely many-flowered; peduncle slender, sheathed basally and at intervals above, 4–5cm long; sheaths ovate, 4–5 × 2–3mm; rachis 2.5–4cm long; floral

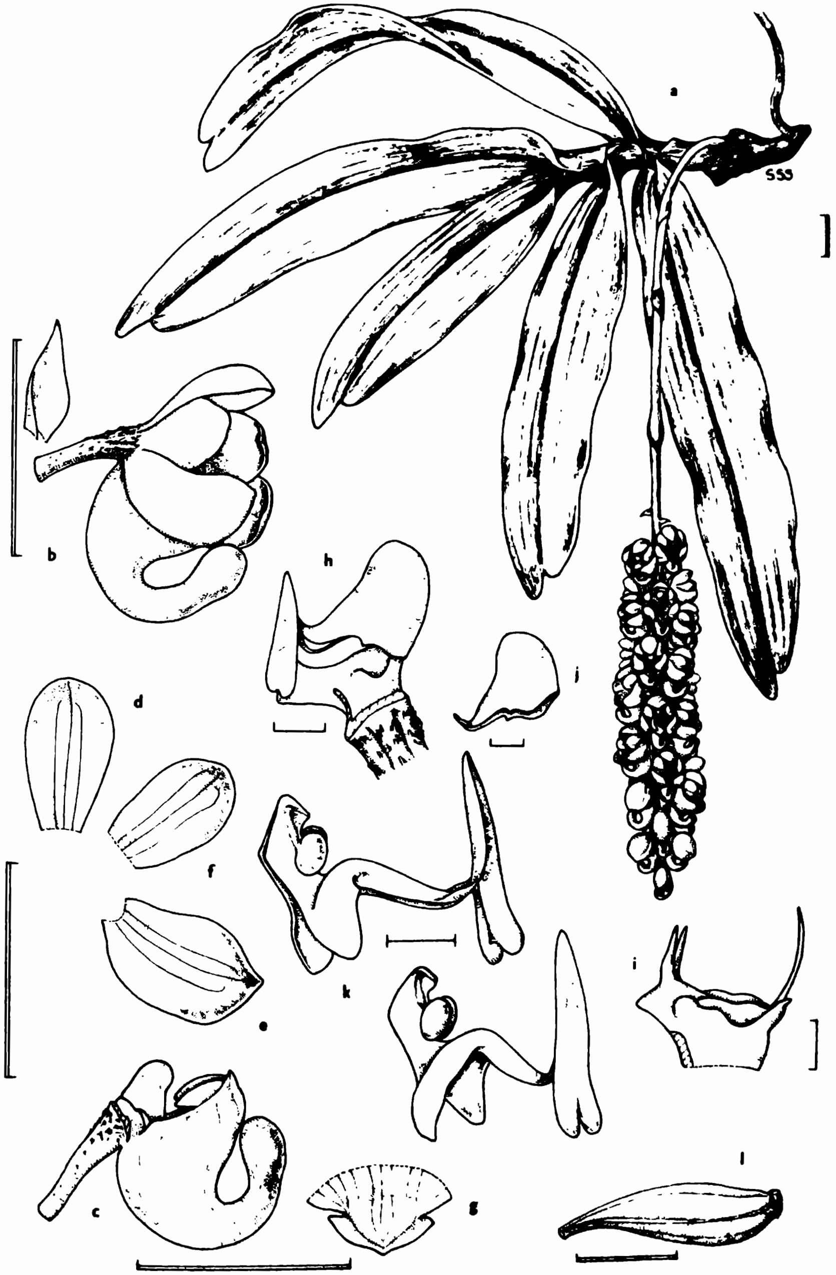

Fig. 133. **Uncifera obtusifolia**: a, habit; b, flower (with detached bract); c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, detail of lip from above (flattened); h, column; i, column (anther cap removed); j, anther cap; k, pollinarium (two views); l, fruit. Drawn by Susanna Stuart-Smith from *Hooker* 194 (K).

bracts lanceolate, acute, 1.5–2mm long. *Flowers* uniformly yellow; pedicel and ovary slender, 4–5mm long. *Dorsal sepal* ovate, concave, apex broad, emarginate, 4–4.5 × 2–2.5mm; *lateral sepals* obliquely obovate, obtuse, connivent, 4–4.5 × 2–2.5mm. *Petals* oblong, obtuse, 3–3.5 × 1.8–2.2mm. *Lip* simple, spurred, boat-shaped, apex fleshy, obtuse, 3–3.5mm long; *spur* funnel shaped, strongly curved forwards, 7–9 × 1–1.7mm (at base). *Column* 1–1.5mm long.

Darjeeling (Rississum). 2000m. Fl. June–July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *lanceolatus* (narrowed and tapered at both ends) and *-folius* (leaved).

3. **U. obtusifolia** Lindl. in J. Proc. Linn. Soc., Bot. 3: 40 (1859). Type: India, Khasia, *Hooker & Thomson* 194 (holo. K-LINDL!).
Uncifera heteroglossa Rchb. f. in Gard. Chron. n.s., 10: 234 (1878). Type: India, Khasia, cult. *Bull* (holo. W! Herb. no. 53390/53391).
Saccolabium obtusifolium (Lindl.) Hook. f., Fl. Brit. India 6(1): 65 (1890).
Gastrochilus obtusifolius (Lindl.) Kuntze, Revis. Gen. Pl. 2: 661 (1891).

Plant pendent, to 30cm tall. *Stem* covered by leaf sheaths, 5–7mm wide; sheaths veined, 1.4–1.6cm long. *Leaves* flat, oblong-elliptic, apex unequally 2-lobed, lobules rounded, base narrowed, jointed, 9–18 × 1.9–3.1cm. *Inflorescence* leaf-opposed, densely many-flowered; peduncle sheathed, glabrous, 5.5–7.5cm long; sheaths broadly ovate, acute, distant, 6–8 × 5–8mm; rachis glabrous, 8.5–9cm long; floral bracts oblong-lanceolate, subacute, 3.5–5 × 1.8–2.1mm. *Flowers* uniformly pale yellow, apices of petals, sepals and lip mid-lobe brighter yellow; pedicel and ovary 4–6mm long. *Dorsal sepal* obovate, obtuse, 3-veined, concave, 3.5–6 × 2–3mm; *lateral sepals* ± spreading, similar. *Petals* broadly obovate, obtuse, 3-veined to apex, 3.5–6 × 2–3.5mm. *Lip* 3-lobed, spurred, 3–4mm long; lateral lobes small, triangular; mid-lobe thickened, laterally compressed, 3-lobulate (posterior lobules oblong, obtuse, decurved; middle lobule broadly triangular, acute); *spur* funnel shaped, strongly curved forwards, base broad, 7–9 × 4–4.5mm (at base). *Column* 2–3mm long; anther cap long-beaked. *Fruit* fusiform, shortly stalked, 1.5–1.7 × 0.3–0.4cm. **Fig. 133.**

Bhutan: S – Phuntsholing district (Kamji (M.F.B.)); (Gheet Valley?); **Sikkim** (Rimbi Chhu). 1000–1660m. Fl. August.

GENERAL DISTRIBUTION. Nepal, NE India and Thailand.
ETYMOLOGY. From the Latin *obtusus* (rounded) and *-folius* (leaved).

131. **Vanda** Jones ex R. Br.

Plants medium-sized to large, epiphytic or lithophytic, monopodial. *Stems* usually stiffly erect. *Leaves* distichous, usually decurved, linear, oblong, rigid, V-shaped in section, apex praemorse, sessile, jointed. *Inflorescence* axillary, laxly racemose. *Flowers* fleshy, resupinate. *Sepals* and *petals* free, elliptic-obovate, twisted or undulate, often tessellated, margins reflexed, narrowed at base. *Lip* immobile, 3-lobed, shortly spurred; *spur* unadorned internally. *Column* short, stout, lacking a foot; rostellum broad, shelf-like; stipes and viscidium short, broad; pollinia 2, grooved.

The generic name *Vanda* was proposed in 1795 by Sir William Jones in *Asiatick Researches* but it was not linked to a specific epipthet. Robert Brown formally established the genus in 1820 in the *Botanical Register* when he described *Vanda roxburghii*, the plant from E Bengal which Jones originally had in mind. The genus comprises about 50 species distributed from Sri Lanka and India to China, SE Asia, the Malay Archipelago, the Philippines, Australia, New Guinea and the Solomon Islands.

Garay (1986b) removed a small group of species allied to *V. alpina* to the segregate genus *Trudelia*. However, we follow Christenson (1992, 1993) who does not accept this separation in his treatment of the genus.

Beetle pollination (cantharophily) has been observed in *V. cristata* by Pradhan (1983), but the identity of the beetle is unknown.

TYPE. *Vanda roxburghii* R. Br.

ETYMOLOGY. From a Sanskrit name for certain parasitic mistletoes (Loranthaceae) and some orchids (including *Vanda roxburghii*) of similar growth habit.

Key to species

1. Peduncle of inflorescence shorter then the pedicel and ovary 2
+ Peduncle of inflorescence exceeding the pedicel and ovary 6

2. Lip apex with 2 elongate, divaricate 2-lobed processes .... **4. V. cristata**
+ Lip apex simple 3

3. Sepals and petals white; flowers more than 5cm across .... **6. V. pumila**
+ Sepals and petals green; flowers less than 2cm across 4

4. Apical portion of lip recurved, convex; callus beneath tip not recessed, forming an elongate cone .... **5. V. griffithii**
+ Apical portion of lip porrect, concave; callus beneath tip recessed, shortly conical 5

5. Flowers green to greenish-white; lip with violet stripes, apex obovate-triangular ... **2. V. alpina**
+ Flowers greenish-yellow; lip unstriped, apex narrowly triangular-lanceolate . **3. V. chlorosantha**

6. Flowers tessellated, more than 4cm across; lip apex 2-lobed .... **1. V. bicolor**
+ Flowers not tessellated, less than 2cm across; lip apex not 2-lobed .... **7. V. testacea**

Section **Obtusiloba** E.A. Christenson in Proc. 14th World Orchid Conf.: 210 (1993).

1. V. bicolor Griff., Itin. Pl. Khasyah Mts.: 132, no. 546 (1848); Not. Pl. Asiat. 3: 354 (1851); Icon. Pl. Asiat.: t.330 (1851). Type: Bhutan, *Griffith* 546 (holo. K-LINDL!).

Plant epiphytic; *roots* arising from between leaf sheaths, terete, 3–4.5mm wide. *Stem* leafy, covered with leaf sheaths, 16–26cm long; sheaths overlapping, veined, 2–2.5cm long. *Leaves* oblong, curved, somewhat twisted in the middle, apex obliquely 2-lobed, lobules tridentate, 7–21 × 1.1–2.3cm. *Inflorescence* piercing through leaf sheath, laxly 3- to 6-flowered; peduncle glabrous, sheathed, 1–12cm long; sheaths distant, 3–4mm long; rachis glabrous, 2–4cm long; floral bracts triangular, base broad, 2–3 × 2.3mm (at base). *Flowers* 4–5cm across; sepals and petals tessellated, yellowish-brown inside, violet externally, lip violet and gold, spur white, column white; pedicel and ovary slender, 4.8cm long. *Dorsal sepal* obovate-spathulate, apex rounded, margins wavy, tessellated behind, 2–2.1 × 1–1.1cm (at widest point); *lateral sepals* similar, spreading, 2–3-2.4 × 1.3–1.4cm. *Petals* narrowly obovate-spathulate, rounded, margins wavy, tessellated behind, 1.7–1.9 × 0.7–0.9cm. *Lip* 3-lobed, spurred, 1.5 × 0.6cm (across mid-lobe); lateral lobes broadly rounded to ovate, subconnate with the column base; mid-lobe hastate-triangular, apex 2-lobed; disc (at base of mid-lobe) 2-callose; *spur* conical, obtuse, pubescent internally. *Column* terete, 6 × 3.5mm; anther cap flat, triangular, 3 × 2mm. *Fruit* long-stalked, 6-ridged, 9.5 × 2.4cm; stalk 5cm long. **Plate 31.**

Bhutan: S – Deothang district (Deothang); C – Tongsa (Mangde Chu, Kinga Rapden), Mongar (near Lhuntse (M.F.B.)) and Tashigang (Manas River, Tashigang (M.F.B.), near Shali (M.F.B.)) districts. On trees in open forest and on riverbanks; 700–2000m. Fl. February–April.

GENERAL DISTRIBUTION. Endemic.

ETYMOLOGY. From the Latin *bi-* (two) and *-color* (coloured) in reference to the flower.

NOTES. This little known species is related to *V. tessellata* (Roxb.) Loddiges and was considered to be doubtfully distinct by Motes (1997). We found this species in flower in Bhutan and believe it to be distinct. The lateral lobes are rounded rather than triangular-acute as in *V. tessellata* and the flowers are distinctively coloured.

Section **Cristatae** Lindl., Fol. Orchid. Vanda 4: 1 (1853).

2. **V. alpina** (Lindl.) Lindl., Fol. Orchid. Vanda 4:10, no.25 (1853). Type: India, Khasia Hills, Nungklow, *Gibson* s.n. (holo. K-LINDL!).
Luisia alpina Lindl. in Bot. Reg. 24: misc.56, no.101 (1838).
Trudelia alpina (Lindl.) Garay in Orchid Digest 50(2): 76 (1986).
Stauropsis alpina (Lindl.) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1: 93 (1951).

Plant epiphytic, often forming clumps, 7–18cm tall; *roots* basal, 1–2mm thick. *Stems* terete, covered by overlapping leaf sheaths, 10–18 × 0.5cm; sheaths veined, 0.6–1.8cm long. *Leaves* broadly linear to oblong, arched, apex unequally 2-lobed, 5–16 × 1–1.4cm. *Inflorescence* short, 1- to 3-flowered; peduncle sheathed, glabrous, 1–2cm long; sheaths ovate, subacute, 3–4mm long; floral bracts triangular, obtuse, 2–3mm long. *Flowers* pendent, 1.5–2cm across; sepals and petals green to yellow-green, lip green with a whitish base, basal sac maroon-purple, apical laminae striped violet, column white; pedicel and ovary ridged, glabrous, 1.2–2.1cm long. *Dorsal sepal* spreading, elliptic-ovate, obtuse, 5-veined, 0.7–1.3 × 0.3–0.5cm; *lateral sepals* spreading, similar. *Petals* spreading, obovate, obtuse, 5-veined, 1–1.2 × 0.3–0.4cm. *Lip* obscurely 3-lobed, deeply gibbous-saccate, 0.8–1.2 × 0.6–0.8cm; lateral lobes small, entire; mid-lobe ovate, obtuse, surface ridged-lamellate, apex obscurely 3-lobed, 3–4 × 2–2.5cm. *Column* fleshy, lacking a foot, 4–5mm long. Fruit clavate, ridged, 6.5 × 1cm. **Fig. 134 n; Plate 32.**

Bhutan: C – Tashigang district (Nagton, near Tashi Yangtsi); **Sikkim** (Namchi, Tendong). In warm broad-leaved forest, on *Tetrodium fraxinifolium* and *Quercus griffithii*; 1250–2000m. Fl. May–July.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. From the Latin *alpinus* (alpine). The species was originally found at 4000 feet in the Khasia Hills, where Lindley stated that snow fell during the cold season.

3. **V. chlorosantha** (Garay) E.A. Christenson in Lindleyana 7(2): 93 (1992). Type: Bhutan, without precise locatity, cult. Trudel 402 (holo. AMES!).
Trudelia chlorosantha Garay in Orchid Digest 50(2): 76 (1986).

Plant epiphytic, to 20cm tall; *roots* fleshy, glabrous. *Stem* ascending, densely leafy. *Leaves* arcuately spreading, linear-oblong, channelled, apex unevenly erose, basally jointed with overlapping sheaths, to 12cm long. *Inflorescence* shorter than leaves, laxly 2- or 3-flowered; floral bracts triangular, acute, c.3mm long. *Flowers* fleshy; sepals, petal and lip uniformly greenish-yellow; pedicel and ovary c.1.6cm long. *Dorsal sepal* linear-oblong, obtuse, c.1.2 × 0.4cm; *lateral sepals* narrowly oblong-elliptic, widely acute, c.1.1 × 0.45cm. *Petals* linear-oblanceolate, acute, c.1.2 × 0.35cm. *Lip* narrowly triangular-lanceolate to narrowly triangular, porrect, base subglobose to saccate, 1.2 × 0.6cm; callus conical (beneath apex). *Column* somewhat swollen near base, c.4mm tall.

Bhutan: (unlocalised Trudel specimen).

GENERAL DISTRIBUTION. Endemic.
ETYMOLOGY. From the Greek *chloros-* (greenish-yellow) and *anthos* (flower).

4. **V. cristata** Lindl., Gen. Sp. Orchid. Pl.: 216 (1833). Type: Nepal, Noakote (Nawakot), coll. *Wallich* Wall. Cat. 7328 (holo. K-LINDL!, iso. K!).
Trudelia cristata (Lindl.) Senghas in Schltr., Orchideen ed.3, 1(19–20): 1211 (1988).

Plant epiphytic, 12–30cm tall; *roots* piercing through leaf sheaths, 2–3mm wide. *Stem* stout, covered by leaf sheaths, 7.5–15cm long; sheaths overlapping, weakly veined, 1–1.5cm long. *Leaves* recurved, coriaceous, apex truncately 3-dentate, 7.5–12.5 × 0.6–1.8cm. *Inflorescence* 2- to 6-flowered; peduncle glabrous, sheathed, 2–3.5cm long; sheaths basal, overlapping, ovate-tubular, mouth wide, 0.4–1cm long; rachis glabrous, weakly zigzag, 2–5cm long; floral bracts broadly ovate to broadly triangular, obtuse, cup-shaped, 4–6mm long. *Flowers* 3.7–5cm across; sepals and petals yellow to green, lip golden-yellow to white, striped with violet-purple to red-brown; pedicel and ovary slender, ridged, 1.5–3cm long. *Dorsal sepal* incurved, spathulate-oblong, obtuse, 2–2.5 × 0.5–0.6cm; *lateral sepals* similar, pendent to spreading, 2–2.8 × 0.5–0.7cm. *Petals* incurved, linear to elliptic, obtuse to rounded, 1.8–2 × 0.2–0.4cm. *Lip* fleshy, saccately spurred, 3-lobed, 2–2.1 × 1.2–1.4cm; lateral lobes erect, small, broadly triangular; mid-lobe oblong, tapering, truncate, upper surface rugulose with 2 slender elongate processes on apical margin, apical sinus with a short point; *spur* saccate, conical, 6–9mm long. *Column* 4–6 × 2mm; anther cap 3–3.5mm wide. Fruit long-stalked, cylindric-obovoid, 7–9 × 0.5–0.9cm (including the stalk). **Plate 32.**

Bhutan: **S** – Chukka district (10km S of Chukka); **C** – Punakha (Bhotokha to Rimchu, Punakha Valley, Tinlegang), Tongsa (Tongsa to Tashiling) and Tashigang (7km before Tashi Yangtsi) districts; **Darjeeling** (Kalimpong); **Sikkim** (Rhenok?). On tree trunks of *Rhododendron arboreum* and *Skimmia* spp.; 1000–2100m. Fl. April–June.

GENERAL DISTRIBUTION. Nepal and NE India.
ETYMOLOGY. From the Latin *cristatus* (crested) in reference to the lip apex.
NOTE. Pradhan (1979) described *V. cristata* var. *multiflora* Hort. which was said to differ in having a 3- to 5-flowered inflorescence and smaller flowers, but we have seen no material of this variety.

5. **V. griffithii** Lindl. in Paxton's Fl. Gard. 2: 22 (1851–52). Type: Bhutan, Monass (Manas) River, *Griffith* s.n. (holo. K-LINDL!).
Vanda sp. Griff., Itin. Pl. Khasyah Mts.: 132, no. 546 (1848).
Luisia griffithii (Lindl.) Kränzlin, Xenia Orchid. 3: 119 (1893).
Trudelia griffithii (Lindl.) Garay in Orchid. Dig. 50(2): 76 (1986).

Plant epiphytic or lithophytic, often forming large clumps, 16–26cm tall; *roots* piercing through leaf sheaths, 2–4mm thick. *Stem* erect, covered by leaf sheaths, 7–13cm long; sheaths overlapping, veined, 1.5–2cm long. *Leaves* weakly curved, oblong, apex unequally 3-lobed, 9–15 × 0.8–1.4cm. *Inflorescences* many emerging from within leaf sheaths, laxly 4-flowered; peduncle glabrous, 1–1.5cm long, sheathed at base; rachis glabrous, straight, 3–3.5cm long; floral bracts ovate to triangular, truncate to obtuse, 3–4mm long. *Flowers* faintly scented, 1.5–2cm across; sepals and petals greenish-yellow, lip greenish with soft purple veins, column white; pedicel and ovary slender, winged, 1.3–1.5cm long. *Dorsal sepal* lanceolate to obovate, obtuse, 1–1.1 × 0.15–0.2cm; *lateral sepals* pendent, lanceolate, subacute, 1.1–1.2 × 0.2–0.25cm. *Petals* spreading, linear-oblong, obtuse, 1 × 0.15cm. *Lip* 3-lobed, saccate at base, 0.6–1.1 × 0.3–0.5cm; lateral lobes semi-circular, short; mid-lobe simple, fleshy, broadly lanceolate, subacute to obtuse, apex recurved, margins weakly undulate. *Column* broad, 2mm long. **Fig. 134a–m; Plate 32.**

Bhutan: **S** – Sarbhang (Gysholing, near Chirang) and Gaylegphug (below Sham Khara) districts; **C** – Punakha (2km below Chuzom, Jala, Tang Chu), Mongar (Thrumsing La) and Tashigang (Manas River) districts; **Sikkim** (unlocalised *Pantling* specimen). On rocks under *Quercus griffithii* on S-facing slopes; 1520–1800m. Fl. March–June.

GENERAL DISTRIBUTION. NE India.
ETYMOLOGY. Named after William Griffith (1810–1845) who made the first collection of plants in Bhutan and was later Superintendent of the Calcutta Botanic Garden.
NOTE. Garay (1986b) discussed this species along with *V. alpina* and *V. chlorosantha*, and provided excellent photographs of each species.

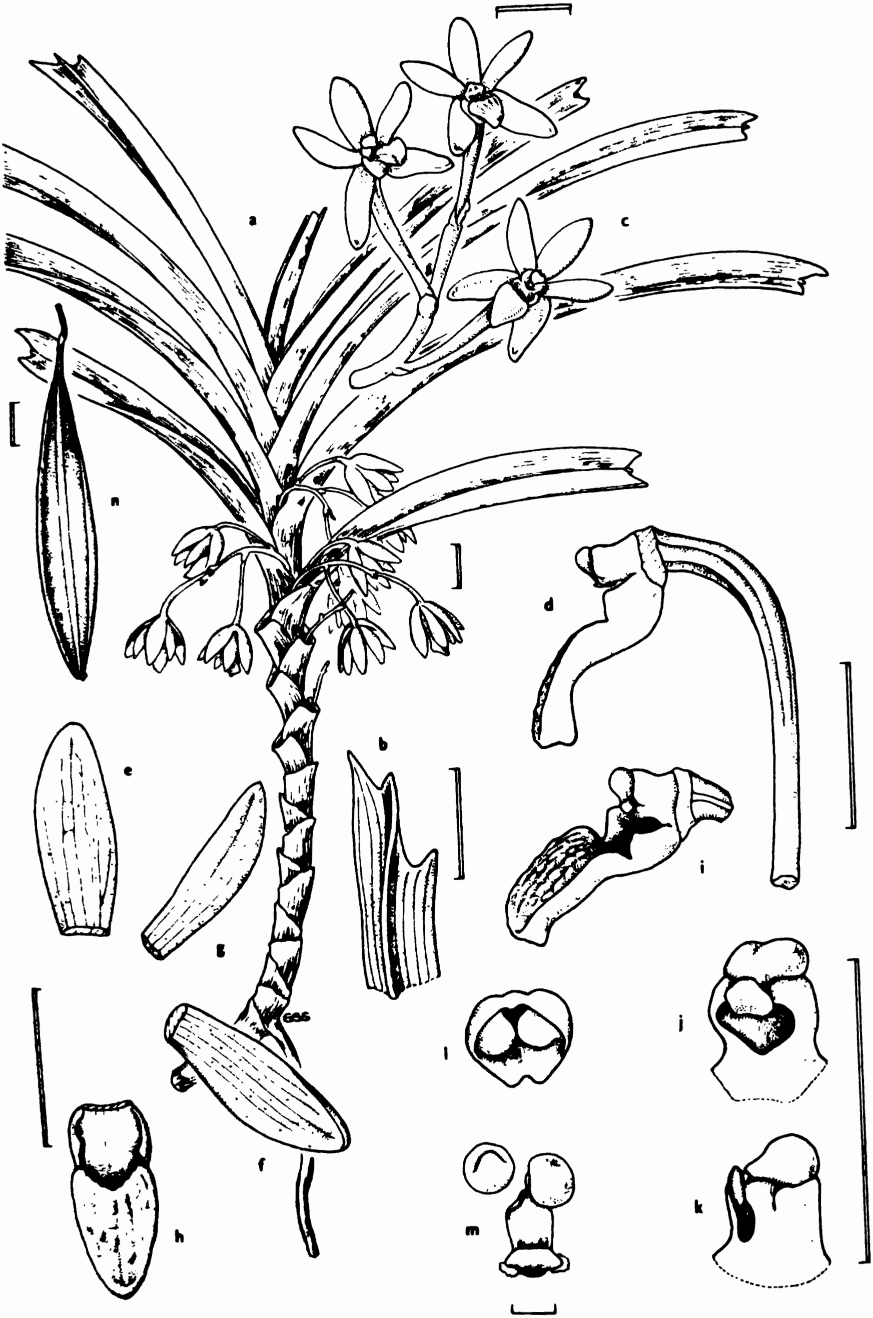

Fig. 134 **Vanda griffithii**: a, habit; b, leaf apex; c, inflorescence; d, lip, column and ovary; e, dorsal sepal; f, lateral sepal, g, petal; h, lip; i, lip and column (side view); j, column (front view); k, column (side view); l, anther cap; m, pollinarium. **V. alpina**: n, fruit. Drawn by Susanna Stuart-Smith, a from *Pantling* 164 (K); b–m from *Grierson & Long* 4511 (E); n from *Strachey & Winterbottom* 22 (K).

6. **V. pumila** Hook. f., Fl. Brit. India 6(1): 53 (1890). Type: Sikkim and Bhutan, icon. Cathcart (holo. K!).
Vanda cristata var. β Lindl., Fol. Orchid. Vanda 4: 10, no.23 (1853).
Trudelia pumila (Hook. f.) Senghas in Schltr., Orchideen ed.3, 1(19–20): 1211 (1988).

Plant epiphytic, 9–23cm tall; roots piercing through leaf sheaths. *Stem* stout, arcuately ascending, covered by leaf sheaths, 5–20cm long; sheaths veined, overlapping, 1.5–2cm long. *Leaves* curved, oblong, apex unequally 3-dentate, 8–24 × 1.2–2cm. *Inflorescence* erect, laxly 1- to 3-flowered; peduncle glabrous, 1.5–3cm long; rachis zigzag, glabrous, 3–3.5cm long; floral bracts elliptic-ovate, obtuse, 3–5 × 2.5–3.5mm. *Flowers* fragrant, 5–6.2cm across; sepals and petals cream to yellow, lip pale cream streaked with purple to red, column white; pedicel and ovary ridged, 2–4.5cm long. *Dorsal sepal* oblanceolate, obtuse to subacute, 2.5–3 × 0.6–0.8cm; *lateral sepals* similar. *Petals* linear, acute, 1.5–2.8 × 0.3cm. *Lip* 3-lobed, saccately-spurred, 1.6–2 × 0.6cm; lateral lobes short, triangular, 2.5 × 2.5mm (at base); mid-lobe broadly ovate, concave, surface 4- to 6-ridged, apex shortly acuminate, with 2 knob-like lumps, 7 × 6mm; spur obconical, 0.9–1.1cm long. *Column* stout, 4–5mm long; anther cap 3mm wide. *Fruit* shortly stalked, cylindric, deeply ridged, 6–7.5 × 1–1.5cm.

Darjeeling (unlocalised *Gammie* specimen); **Sikkim** (unlocalised *Pantling* specimen). Fl. May.

GENERAL DISTRIBUTION. NW and NE India, Nepal, Myanmar, China (Yunnan), Thailand, Laos, Vietnam and Sumatra.
ETYMOLOGY. From the Latin *pumila* (dwarf).

Section **Longicalcarata** E.A. Christenson, Proc. 14th World Orchid Conf.: 212 (1983).

7. **V. testacea** (Lindl.) Rchb. f. in Gard. Chron. n.s. 8: 166 (1877). Type: Sri Lanka (Ceylon), *Macrae* s.n. (holo. K not found, probably lost)
Aerides testaceum Lindl., Gen. Sp. Orchid. Pl.: 238 (1833).

Plant epiphytic; roots elongate, thick, aerial. *Stem* erect, covered by leaf sheaths, 20cm long; sheaths overlapping, 1–1.5cm long. *Leaves* equitant, oblong, coriaceous, apex unequally 2-lobed, 3-dentate, lobules triangular to rounded, 7.5–26 × 1.3–1.9cm. *Inflorescence* laxly many-flowered; peduncle stout, sheathed, 5–25cm long; rachis 6–12.5cm long; floral bracts broadly ovate, acute, 1.5–2 × 2.6–3mm. *Flowers* 1.8–2cm across; sepals and petals cream-yellow, lip white, purple or reddish-pink; pedicel and ovary slender, 1.5–2.5cm long. *Dorsal sepal* obovate-spathulate, obtusely rounded and incurved at apex, 6–11 × 2.7–5.2mm; *lateral sepals* spreading, obovate-spathulate, falcate, apex rounded, incurved and twisted, 5.6–9.2 × 2.8–5.4mm. *Petals* spreading, spathulate, concave, base narrow and twisted, 5.2–10.8 × 2.2–4.6mm. *Lip* 3-lobed, spurred, sessile, 9.5mm long; lateral lobes erect, oblong, obtuse; mid-lobe recurved, subquadrate to oblong, apex, dilated, emarginate, margins crenulate, 6.4 × 3.5mm; disc with 2 broad, fleshy ridges; spur narrow, funnel shaped, 3.1mm long. *Column* truncate, 2.8mm tall. *Fruit* long-stalked, 2.5–3.5 × 0.8cm; stalk 1.8–2.2cm long.

Bhutan: S – Sarbhang district (Chirang, Kami Khola); **C** – Tashigang district (near Tashi Yangtsi (M.F.B.)); **Sikkim** (unlocalised *Pantling* specimen). In dry broad-leaved forest, on *Terminalia chebula*; 780–2000m. Fl. May–June.

GENERAL DISTRIBUTION. Sri Lanka, India, Myanmar, China and Thailand.
ETYMOLOGY. From the Latin *testaceus* (brownish-yellow) in reference to the sepals and petals.
NOTE. Seidenfaden (1988) summarised the taxonomic confusion over this species and gave a full synonymy.

Doubtfully recorded and imperfectly known species (including species reported from the W Kameng district of Arunachal Pradesh but not from Bhutan).

V. coerulea Griff. ex Lindl. in Bot. Reg. 33: *sub* t.30 (1847). Type: India, Assam, Khasia Hills, *Griffith* s.n. (holo. K-LINDL! iso. K!).

NOTES. Pradhan (1979) reported this from Arunachal Pradesh and it is found in Meghalaya. There is a Hooker specimen from Sikkim (K) labelled *V. coerulea* but the collection lacks flowers and its identity is doubtful.

V. coerulescens Griff., Not. Pl. Asiat. 3: 352 (1851); Icon. Pl. Asiat.: t.331 (1851). Type: Myanmar (Burma), Bhamo, *Griffith* 5187 (holo. K!).

NOTE. Reported from the Kameng district of Arunachal Pradesh by Hegde (1984).

V. stangeana Rchb. f. in Bot. Zeit. 16: 351 (1858). Type: India, Assam, *Schiller/Stange* (holo. W?).

NOTE. Reported by Chowdhery (1998) from the Kameng region of Arunachal Pradesh.

V. tessellata (Roxb.) Loddiges in Bot. Cab. 11: Cat. Pl., 17 (1826). Type: India, Circar Mountains, [icon. of] '*Epidendrum tesselatum*' Roxburgh 242 (holo. CAL, iso. K!).
Epidendrum tessellatum Roxb., Pl. Coromandel 1: 34, t.42 (1795).

NOTES. Reported by Kumar *et al.* (1997) from Sikkim and between W Bengal and Kalimpong (*Y. Kumar* 17021 NEHU). We have not seen any material from our area, but see also note under *V. bicolor* above.

132. Vandopsis Pfitzer

Plants epiphytic or terrestrial, monopodial. *Stem* rigid, elongate. *Leaves* distichous, coriaceous, flat, jointed. *Inflorescence* axillary, racemose. *Flowers* fleshy, resupinate, flat, medium to large. *Sepals* and *petals* spreading. *Lip* firmly adnate to the column, geniculately bent, ± channelled or gibbous at base. *Column* short, lacking a foot; pollinia 2, deeply grooved, in unequal pairs, sessile; stipes broadly oblong; viscidium transverse, prominent.

The genus *Vandopsis* was established in 1889 by E. Pfitzer in Engler & Prantl's, *Die Naturlichen Pflanzenfamilien*. The genus comprises five species distributed in India, China, SE Asia, the Philippines, the Malay Archipelago and Indonesia to New Guinea.

The complex history of the genus was summarised by Seidenfaden (1988).

TYPE. *Vandopsis lissochiloides* (Gaudichaud) Pfitzer; basionym: *Fieldia lissochiloides* Gaudichaud.
ETYMOLOGY. From *Vanda* (an orchid genus) and the Greek suffix *-opsis* (resembling) implying a resemblance.

1. **V. undulata** (Lindl.) J.J. Smith in Natuurk. Tijdschr. Ned.-Indië. 72: 77 (1912). Type: India, Sikkim, icon. Cathcart s.n. (holo. K!).
Vanda undulata Lindl. in J. Proc. Linn. Soc., Bot. 3: 42 (1859).
Stauropsis undulatus (Lindl.) Bentham ex Hook. f., Fl. Brit. India 6(1): 27 (1890).
S. polyantha W.W. Smith in Notes Roy. Bot. Gard. Edinburgh 13: 220 (1921). Types: Myanmar (Burma), Kachin Hills, *Kingdon-Ward* 207 (syn. E); Taping, *Forrest* 13729 (syn. E); China, Yunnan, *Forrest* 12039, 15806, 17973 (syn. E).

Plant epiphytic or terrestrial; *roots* piercing through leaf sheaths, long, c.2mm thick. *Stem* covered by leaf sheaths; sheaths minutely warty, 2.5–4cm long. *Leaves* oblong, apex unequally 2-lobed, lobules

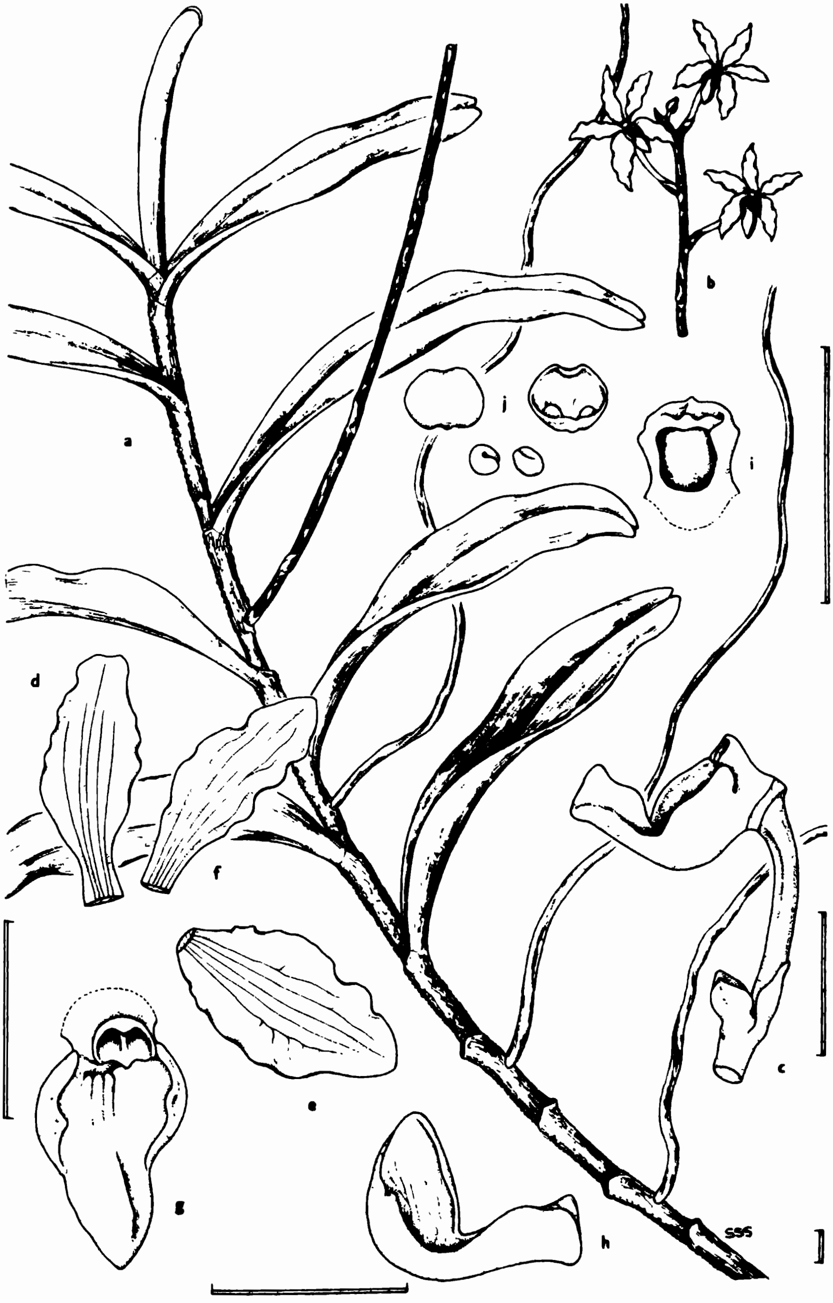

Fig. 135. **Vandopsis undulata**: a, habit; b, inflorescence; c, lip, column and ovary; d, dorsal sepal; e, lateral sepal; f, petal; g, lip; h, lip (from side); i, column; j, anther cap and pollinia. Drawn by Susanna Stuart-Smith, a from *Pantling* 72 (K); b–j from *Herklots* 4 (K).

rounded, narrowed slightly at base, 5.5–13 × 0.9–2cm. *Inflorescence* leaf-opposed, laxly few-flowered; peduncle glabrous, sheathed, 12–25 × 2–2.5mm; sheaths distant, broadly ovate, appressed, 6–7mm long; rachis glabrous, 3–12cm long; floral bracts ovate-lanceolate, subacute, 6–8 × 4–5mm. *Flowers* 3–3.6cm across; sepals and petals white, lip yellow to white at apex, lemon-yellow with purple-red striations at base, anther cap yellow; pedicel and ovary slender, 2–2.5cm long. *Dorsal sepal* oblong-spathulate, 5-veined, margins undulate, 1.5–1.8 × 0.5–0.7cm; *lateral sepals* spreading, similar. *Petals* spreading, narrowly oblong-spathulate, 5-veined, margins undulate, 1.4–1.6 × 0.2–0.4cm. *Lip* fleshy, 3-lobed, adnate to the column, 1–1.4cm long; lateral lobes erect, rounded, surrounding the column; mid-lobe spathulate, truncate, concave, laterally compresed, 6 × 5mm; disc with 2 ridges from base. *Column* stout, 3–4 × 2–2.5mm; pollinia c.1mm across; stipe 0.4–0.5mm long. **Fig. 135; Plate 32.**

Bhutan: C – Punakha (Samtengang to Ritang, Tinlegang), Tongsa (Shemgang, Tongsa to Tashiling) and Tashigang (near Gamdrithang (M.F.B.), Tashi Yangtsi Dzong) districts; **N** – Upper Kuru Chu (Denchung) and Upper Kulong Chu (Tobrang (M.F.B.)) districts; **Darjeeling** (Happy Valley, Kalimpong); **Sikkim** (Chiya Bhanjang to Dentam, Chunthang). On *Pinus kesiya* and oak trees, on shaly soils; 1500–2300m. Fl. April–May.

GENERAL DISTRIBUTION. NW India, Nepal and NE India.

ETYMOLOGY. From the Latin *undulatus* (wavy) in reference to the sepal and petal margins.

APPENDIX

Species belonging to doubtfully recorded and imperfectly known genera (including ones recorded from the W Kameng district of Arunachal Pradesh).

1. **Collabium chinense** (Rolfe) T. Tang & F.T. Wang in Anon., Icon. Corm. Sinic. 5: 684 (1976). Type: China, *Hance* 17733 (holo. BM).
Nephelaphyllum chinense Rolfe in Bull. Misc. Inform. Kew 1898: 194 (1896).
Chrysoglossum robinsonii Ridley in J. Fed. Malay States Mus. 6(3): 157 (1915).
Tainia chinense (Rolfe) Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 4: 706 (1932).
T. balansae Gagnepain in Bull. Mus. Natl. Hist. Nat. sér.2, 4: 706 (1932).
Collabium balansae (Gagnepain) T. Tang & F.T. Wang in Acta Phytotax. Sin. 1(1): 77 (1951).

NOTES. Reported from the W Kameng district of Arunachal Pradesh by Hegde & Rao (1985). Van der Burgh & de Vogel (1997) reported it from China, Thailand and Vietnam and we have seen no material from our area.

2. **Cyrtosia javanica** Bl., Bijdr.: 396 (1825). Types: Java, *Blume's collector* s.n. (syn. L! Herb. no. 902322256); Java, Djati Kalangan, *Waitz* s.n. (syn. L! Herb. no. 9023222254); Indonesia, *Blume's collector* s.n. (syn. L! Herb. no. 9023222253).
Galeola javanica (Bl.) Bentham & Hook. f., Gen. Pl. 3: 590 (1883).

NOTES. Reported by Hegde & Rao (1983b) and Rao (1988) from Sessa in the W Kameng district of Arunachal Pradesh. Garay (1986a) questioned the indentity of the Thai plants illustrated by Seidenfaden (1978a) and they were later (Seidenfaden, 1995a) re-identified as *Cyrtosia plurialata* Seidenfaden. We are doubtful about reports of the species from our area.

3. **Dactylorhiza hatagirea** (D. Don) Soó in Nom. Nova. Gen. Dactylorhiza 4 (1962). Type: India, ?Assam, 'Sirinagur, Kamroop', *Buchanan-Hamilton* s.n. (holo. BM, not found).
Orchis hatagirea D. Don, Prodr. Fl. Nepal.: 23 (1825).
O. latifolia var. *indica* Lindl., Gen. Sp. Orchid. Pl.: 260 (1835). Type: Nepal, Gossainthan, *Wallich's collectors* Wall. Cat. 7062 (holo. K-LINDL!, iso. K-W!).
O. latifolia sensu Hook. f., Fl. Brit. Ind. 6: 127 (1890), non. Lindl.

NOTES. Hara, Stearn & Williams (1978) reported a distribution range from Kashmir to Bhutan and SE Xizang, and Chowdhery (1998) reported it from the Kameng district of Arunachal Pradesh. We have not seen any material from our area and doubt its occurrence. Lang (1999) reduced *D. hatagirea* to synonymy under *Orchis latifolia* L., a name formerly applied to the European species *D. incanata* (L.) Soó; the taxonomy of this species is complex and it is generally treated within *Dactylorhiza*, but this treatment seems extremely dubious.

4. **Hygrochilus parishii** (Veitch & Rchb. f.) Pfitzer in Engler, Nat. Pflanzenfam. 1: 112 (1897). Type: Myanmar, Moulmein, *Parish* 178 (holo. W! Herb. no. 26298, iso. K!).
Vanda parishii Veitch & Rchb. f. in Gard. Chron. 1867: 180 (1867).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

5. **India arunachalensis** A.N. Rao in J. Econ. Taxon. Bot. 22(3): 701 (1998). Type: India, Arunachal Pradesh, W Kameng, Diomara, A.N. *Rao* 30054 (holo. Orchid Herbarium Tipi).

NOTES. This new genus is related to *Saccolabiopsis* but has a spur with a back wall callus and pubescent within; the pollinia are entire. It is also related to *Malleola* J.J. Smith & Schltr., but the spur is not septate, the back wall callus is uncinate, and the stipe is clavate.

6. **Pennilabium proboscideum** A.S. Rao & Joseph in Bull. Bot. Surv. India 10(2): 231 (1968). Type: India, Assam, Umran-Umsaw, A.S. *Rao* 45622 (holo.CAL, iso. ASSAM).

NOTE. Reported by Rao (1998c) from the W Kameng district of Arunachal Pradesh.

7. **Pennilabium struthio** Carr in Gard. Bull. Straits Settlem. 5: 151 (1930). Type: Malaysia, Kuala Teku, Pahang, *Carr* 174 (holo. K!).

NOTE. Reported by Rao (1996b) from the W Kameng district of Arunachal Pradesh.

8. **Renanthera imschootiana** Rolfe in Bull. Misc. Inform. Kew 1891: 200 (1891). Type: Country of origin uncertain, ? India, cult. Imschoot s.n. (holo. K!).

NOTE. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh.

9. **Sarcoglyphis arunachalensis** A.N. Rao in Nordic J. Bot. 10: 161 (1990). Type: India, Arunachal Pradesh, W Kameng district, Sessa, *Hegde* 4199 (holo. Orchid Herbarium Tipi).

NOTES. This new species from the W Kameng district of Arunachal Pradesh is related to S. *thailandica* Seidenfaden, but can be distinguished by its elongate branched racemes, the incurved lateral lobes of the lip, the spicule at the apex of the mid-lobe and a spur lacking any internal septum.

10. **Seidenfadeniella rosea** (Wight) Sathish Kumar in C. Sathish Kumar & K.S. Manilal, Cat. Ind. Orchids: 46 (1994). Type: India, Nilgiri Hills, *Wight* (holo. K, not found).
Sarcanthus roseus Wight, Icon. Pl. Ind. Orient. 5(1): 10, t.1685 (1852).
Schoenorchis roseus (Wight) Bennett in J. Econ. Taxon. Bot. 6(2): 456 (1985).
Saccolabium filiforme Lindl. var. *nilgirica* Fyson, Fl. Nilgiri & Pulney Hill-tops 1: 396 (1915). Type: India, Pykara, *Fyson* s.n. (holo. PCM).

NOTES. Reported by Chowdhery (1998) from the Kameng district of Arunachal Pradesh. We have seen no material of this species from our area. The taxonomy of this species is complex and was discussed by Seidenfaden (1992) and Sathish Kumar & Manilal (1994) who proposed the transfer to *Seidenfadeniella* which we follow here.

11. **Stereosandra javanica** Bl., Mus. Bot. 2: 176 (1856). Type: W Java, Bantam Province, Kuhl & *Hasselt* s.n. (holo. L! 903162784).
Stereosandra pendula Kränzlin in Bot. Tidsskr. 24: 11 (1900).
S. *koidzumiana* Ohwi in J. Jap. Bot. 13: 44 (1937).
S. *liukiuensis* Tuyama in Nakai, Iconogr. Pl. As. Orient. 2: 182, t.68 (1938).

NOTE. Reported by Hegde & Rao (1987) from Tipi in the W Kameng district of Arunachal Pradesh.

12. **Trias disciflora** (Rolfe) Rolfe, Hand-List Orch. Cult. Roy. Gard. Kew ed.1: 35, 215 (1896). Type: Laos, unlocalised, *Linden* s.n. (holo. K!, iso. BR).
Bulbophyllum disciflorum Rolfe in Bull. Misc. Inf. Kew 1895: 7 (1895).

NOTE. Reported by Rao & Hegde (quoted in Chowdhery, 1998) from the Kameng district of Arunachal Pradesh.

13. **Trias nasuta** (Rchb. f.) Stapf in Bot Mag. 152: sub t.9150 (1928). Type: Myanmar, Moulmein, Parish 263 (holo. W! Herb. no. 52443, iso. K!).
Bulbophyllum nasutum Rchb. f. in Gard. Chron. 1871: 1482 (1871).

NOTE. Reported by Rao & Hegde (quoted in Chowdhery, 1998) from the Kameng district of Arunachal Pradesh.

GLOSSARY

abaxial: facing away from the axis.
adaxial: facing towards the axis.
adnate: united or joined together.
apiculate: with a short, sharp (but not stiff) point.
anticous: facing the axis (e.g. of anther dehiscence meaning introrse).
antrorse: turned backwards, directed upwards.
appressed: lying flat for whole length of organ.
arcuate: arched.
areolate: divided into a number of irregular squares.
aristate: awned, sharply terminated by a hard, straight point.
auriculate: with a small ear-like lobe.

bifurcate: forked.
bullate: blistered (of surfaces).

caducous: falling early.
caespitose: tufted.
callus: a thickened area on the lip.
calyculus: cup-like structure at the base of an organ.
campanulate: bell-shaped.
carinate: keeled.
ciliate: fringed with hairs.
clavate: club-shaped.
clinandrium: the anther-bed, that part of the column in which the anther is concealed.

conduplicate: leaves with a single median fold, each half being flat.
connivent: coming into contact, converging.
convolute: rolled (referring to the leaf during development, which can be plicate or conduplicate when mature).
cordate: heart-shaped.
coriaceous: leathery, thick.
crenate: scalloped.
cuspidate: tipped with a sharp, rigid point.

decurved: curved or bent down.
deflexed: bent outwards.
dentate: toothed.
duplicate: folded once, with each half flat (referring to the leaf during development, which is always conduplicate when mature).

echinate: with numerous stiff hairs or spines.
emarginate: notched (usually referring to the apex).
epichile: the apical portion of the lip (when separated from the basal portion).
excavate: with a hole or channel.

falcate: sickle-shaped.
fasciculate: clustered or bundled.
filiform: thread-like.
fimbriate: fringed.
fusiform: spindle-shaped.

geniculate: abruptly bent like a knee-joint.
gibbous: pouched.
glabrous: hairless.
globose: spherical.
glumaceous: resembling the small, dry floral bracts of grasses.
glutinous: sticky, like glue.

hamulus: a pollinium stalk developed from the apex of the rostellum.
hastate: spear-shaped, with the basal lobes turned outwards.
heteranthous: used of an apical inflorescence produced on a separate shoot which does not develop to produce pseudobulbs or leaves.
hypochile: the basal portion of the lip (when separated from the apical portion).
hysteranthous: used of an apical inflorescence produced after the pseudobulbs and leaves have developed.

incumbent: lying on or against.

lacinate: deeply cut into narrow divisions.
lanceolate: lance-shaped, tapering towards both ends.
lingulate: tongue- or strap-shaped
lithophytic: growing on rocks.

mentum: a chin-like projection formed by the sepals and the extended column foot.
mesochile: the central portion of a divided lip.
mobile (referring to a lip): a lip that has active, rather than passive, movements.
moniliform: resembling a string of beads.
mycotrophic: where a plant gains its nutrition from a mycorrhizal fungus rather than through photosynthesis (plant usually brown and lacking developed leaves).
mucronate: with a sharp terminal point.

operculum: lid (usually of an anther).

pandurate: violin-shaped.
paniculate: branched, branching (of an inflorescence).
papillose: covered with soft glands or protuberances.
pectinate: comb-like.
peduncle: the stalk bearing an inflorescence.
peltate: shield-shaped.
pendent: hanging.
petiole: the leaf stalk.
plicate: pleated, referring to leaves with several longitudinal veins and usually folded at each one.
porrect: directed outwards and forwards.
praemorse: bitten off, ragged.
proteranthous: of an apical inflorescence produced before the pseudobulbs and leaves, but on the same shoot.
pulvinate: cushion-like
pyriform: pear-shaped.

rachis: the flower-bearing part of the floral axis.
ramentae: thin, membranous or chaffy, flattened scales.
recurved: curved backwards or downwards.
reniform: kidney-shaped.

retroflexed: turned backwards.
retuse: shallowly notched at a rounded apex.
revolute: rolled back from the margin.
rubiginous: rust coloured.
rugose: wrinkled.

scaberulous: slightly rough to the touch.
scandent: climbing.
sectile: (of pollen) soft.
secund: turned to face the same direction.
serrulate: with sharp, saw-like teeth.
sessile: lacking a stalk.
setaceous: thread- or bristle-like.
setose: bristly.
spathulate: oblong, like a spatula.
staminode: a sterile stamen.
stigmatophore: structure bearing the stigmatic lobes (in *Habenaria*).
stipitate: raised on a stalk.
synanthous: where the pseudobulb, leaf, and apical inflorescence are produced together.
synsepalum: two united sepals, as in *Paphiopedilum*.

terete: circular in cross section.
tomentose: covered with short, matted hairs.
trigonous: having three angles.
truncate: ending abruptly, as though broken or torn off.

umbonate: having a central, projecting point, like the boss of a shield.
undulate: waved.
unguiculate: contracted at base into a claw.
urceolate: pitcher-, vase- or urn-shaped.

ventricose: swollen or inflated on one side.
verrucose: covered with wart-like growths.
verticillate: whorled.
villose: with long, weak hairs.

CHECKLIST OF SPECIMENS EXAMINED

Acampe ochracea: Bhutan: Griffith 5 (K-LINDL); 547 (K-LINDL); 5233 (K); Sikkim: Hooker 179 (K-LINDL); s.n. (K); Pantling 133A (W); 133B (BM, K).
A. papillosa: Terai: Kurzweil 251 (K); Darjeeling: Gamble 7166 (K); Hara & Togashi 3285 (TI); Sikkim: Hooker 195 (K); Pantling 243 (BM, K, W).
A. rigida: Bhutan: Kanai, Murata, Ohashi, Tanaka & Yamazaki 14105 (TI); Sikkim: Pantling 250 (BM, K, W).

Acanthephippium striatum: Duars: Pantling 269 (BM, K, W); Darjeeling: Griffith 5289 (K); s.n. (K-LINDL); Sikkim: Hara, Kurosawa & Ohashi s.n. (TI).
A. sylhetense: Sikkim: Pantling 121A (W); 121B (BM, K, W).

Acrochaene punctata: Darjeeling: Gamble 9994 (K); Sikkim: Hooker 40 (K-LINDL); s.n. (AMES, K, L, W); King 3085 (BM, K); s.n. (K); Pantling 25 (BM, K, W).

Aerides multiflorum: Bhutan: Dorji, Pearce & Cribb 16 (E, K, THIM); Grierson & Long 883 (E); 3337 (E); Griffith 5224 (K); s.n. (K-LINDL); Gurung s.n. (Herb. D.B. Gurung); Kanai, Murata, Ohashi, Tanaka & Yamazaki 670002 (TI); Darjeeling: Griffith 5239 (K); s.n. (W); Darjeeling/Sikkim: Gamble 9432 (K); Sikkim: Pantling 446 (BM, K, W).
A. odoratum: Bhutan: Grierson & Long 3338A (E); 3560 (E); Sikkim: Hooker 182 (K-LINDL); s.n. (E, K); Pantling 443A (BM, K, W); 443B (BM).
A. roseum: Bhutan: Griffith 5223 (K); Ludlow & Sherriff 3166 (BM, E).

Agrostophyllum brevipes: Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1703 (TI); Pantling 34 (AMES, BM, K, L, W).
A. callosum: Bhutan: Grierson & Long 3233 (E); Griffith 18 (K-LINDL); 5215 (K); Gurung 78 (Herb. D.B. Gurung); Darjeeling: Gamble 8271 (K); 10582 (K); Sikkim: Cave s.n. (E); Clarke 25423 (BM); s.n. (W); Gammie s.n. (K); Hara & Togashi 1709 (TI); Hara, Kurosawa & Ohashi s.n. (TI); Hooker 201 (K-LINDL); s.n. (BM, E, K, W); Long, McBeath, Noltie & Watson 789 (E); Pantling 477A (BM, K, W); 477B (BM, K, W).
A. myrianthum: Sikkim: Pantling 459 (BM, K, W).
A. planicaule: Sikkim: King s.n. (BM); Pantling 280A (BM, K); 280B (K).

Androcorys gracilis: Bhutan: Grierson & Long 2815 (E); Miehe 00-205-52 (MB); 00-385-17 (MB); Darjeeling: Gamble 9570 (K); Sikkim: Pantling 374B (BM, K, W); 397A (BM, K, W); 397B (BM, E, K, W); Chumbi: Pantling 374A (BM, E, K, L, W).
A. pugioniformis: Bhutan: Miehe 00-175-24 (MB); 00-325-06 (MB); 00-329-04 (MB); 00-364-03 (MB); 00-401-15 (MB); 00-403-07 (MB); Darjeeling: Kanai, Ohashi, Hara, Iwatsuki & Ohba 721363 (TI); 721383 (TI); 726138 (TI); Sikkim: Hooker s.n. (K-LINDL, K); Chumbi/Bhutan: Rohmoo 498 (E).

Ania penangiana: Duars: Haines 2839 (K); Darjeeling: Pantling 204A (AMES, BM, K); 204B (BM, K, W).

Anoectochilus brevilabris: Sikkim: Pantling 285A (BM, K, W); 285B (BM, L).
A. roxburghii: Bhutan: Griffith 5332 (K); Sikkim: Gammie s.n. (K); Pantling 6 (BM, K, W).

Anthogonium gracile: Bhutan: Bigger 3000 (E); Bowes Lyon 13037 (E); 13044 (E); Cooper 2820 (BM); 3304 (BM, E); Hara, Kurosawa & Chuma s.n. (TI); Ludlow & Sherriff 337 (BM, E, K); Ludlow, Sherriff & Hicks 17022 (BM, E); 20873 (BM, E); Sargent 228 (E); Sinclair & Long 4950 (E, K); 5623 (E); Tshering & Nawang s.n. (E); Wood 6574 (E); Darjeeling: Anderson 1237 (W); Clarke 9210 (W); 13264 (E, K, W); 27304 (BM); 35857 (BM); Cowan s.n. (E, K); Drummond 20979 (K); 20980 (K); Gamble 3971 (K); 9751 (K); Hara s.n. (TI); Kanai, Ohashi, Hara, Iwatsuki & Ohba 726073 (TI); Sikkim: Cave s.n. (E); Clarke 25030 (BM, K); Long, McBeath, Noltie & Watson 868 (E); Pantling 54A (BM, K, W); 54B (E, K, NBG, W); Pradhan, Norbu & Naku 142 (E); Townend 153 (OXF); Treutler 711 (K).

Aorchis spathulata: Bhutan: Bedi 251 (K, THIM); Bowes Lyon 9096 (E); 13071 (E); Cooper 1979 p.p. (E); 2479 (E); Gould 338 (K); 495B (K); Ludlow & Sherriff 247 (BM); 369 (BM); 3255 (BM); Ludlow, Sherriff & Hicks 16635 (BM, E); 19015 (BM); 20346 (BM); 20812 (BM, E); Miehe 00-172-07 (MB); Wood 5572 (E); 7009 (E); Sikkim: Bor & Ram 19793 (K); 19930 (K); Cave 188 (E, K); Cooper 12 (BM, E); Dungboo s.n. (K); Gammie 776 (BM); Hooker 277 (K-LINDL); s.n. (AMES, BM, K, OXF); King 4224 (K); Long, McBeath, Noltie & Watson 412 (E); 737 (E); Long & Noltie 179 (E); Lowndes 622 (E); 4735 (E); Pantling 327A (BM); 327B (BM, E, K); Starling, Upward, Brickell & Mathew (AGSES) 275 (K); Wager 310 (K); Younghusband 6 (K); s.n. (K); Chumbi: Bor & Ram 19634 (K); 20055 (K); 20581 (K); Gould 2038 (K); Hobson s.n. (K); King's collector 545 (E, K); Pantling 382 (BM, K); Waddell 104 (K).

Aphyllorchis alpina: Sikkim: Long, McBeath, Noltie & Watson 765 (E); Pantling 462 (BM, K, W).
A. montana: Darjeeling: Griffith 5360 (K); Kanai, Ohashi, Hara, Iwatsuki & Ohba 721562 (TI); 726104 (TI); Sikkim: Pantling 344A (BM, K, W); 344B (NBG).

Apostasia wallichii: Darjeeling: Clarke 36988 (BM, W); Cowan s.n. (E, K); Sikkim: Pantling 414 (BM, W).

Appendicula cornuta: Sikkim: Pantling 288A (BM, K); 288B (K).

Arundina graminifolia: Bhutan: Booth s.n. (W); Bowes Lyon 15155 (BM); Broad s.n. (E); Cooper 4203 (BM, E); Dorji, Pearce & Cribb 23 (THIM); Gould 809 (K); Grierson & Long 1515 (E); 1708 (E, K); 2144 (E, K); Griffith 5196A (K,W); s.n. (W); Lister 11 (K); Ludlow &

CHECKLIST OF SPECIMENS EXAMINED

Sherriff 317 (BM, E); 1067 (BM); Ludlow, Sherriff & Hicks 20929 (BM, E); Sargent 192 (E); Terai: J.J. Wood 148 (K); Darjeeling: Cowan s.n. (E); Gamble 187 (K); Griffith 5196B (K); Kanai, Murata & Togashi 1707 (TI); Murata & Togashi 1706 (TI); King s.n. (W); Sikkim: Cave s.n. (E); s.n. (E); Clarke 8985 (K, W); Gamble 3984 (E); 7353 (K); Hooker 149 (K-LINDL); s.n. (AMES, BM, K, OXF, W); Pantling 17A (BM, K, W); 17B (BM, K, W); Treutler 406 (K).

Ascocentrum ampullaceum: Bhutan: Grierson & Long 3620 (E, K, THIM); 3918 (E); Sikkim: Clarke 35416 (K); Hooker 196 (K-LINDL); s.n. (K); Hooker & Thomson s.n. (K); Pantling 259A (E, K); 259B (BM, K, W); Togashi s.n. (TI).
A. himalaicum: Bhutan: Deb 424 (CAL, n.v.).

Bhutanthera albomarginata: Sikkim: King 4367 (K); Long & Noltie 71 (E); Pantling 450 (BM, E, K, L, W); Rohmoo 1098 (E).
B. albosanguinea: Bhutan: Wood 7405 (E).
B. alboviréns: Bhutan: Ludlow & Sherriff 3441 (BM); Ludlow, Sherriff & Hicks 21196 (BM); Miehe 00-191-45 (MB).
B. alpina: Bhutan: Ludlow, Sherriff & Hicks 21345 (BM, E); Miehe 00-190-12 (MB); 00-190-13 (MB); Sikkim: Long, McBeath, Noltie & Watson 362 (E).
B. himalayana: Bhutan: Cooper 1979 (E); Gould 1294 (K); Ludlow, Sherriff & Hicks 16640 (BM); 19304 (BM, E); 19413 (BM, E); 20401 (BM).

Biermannia bimaculata: Sikkim: Pantling 209A (BM, K, W); 209B (AMES, BM, K, W).

Brachycorythis obcordata: Bhutan: Bowes Lyon 15162 (BM); Cooper 2411 (BM, E); 2855 (BM, E); 3163 (BM, E); 4374 (BM, E); Gurung 25 (Herb. D.B. Gurung); s.n. (Herb. D.B. Gurung); Ludlow & Sherriff 315 (BM, E, K); Ludlow, Sherriff & Hicks 20897 (BM); Wood 6642 (E)

Bulbophyllum affine: Bhutan: Gurung 69 (Herb. D.B. Gurung); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1704 (TI); Pantling 154A (K); 154B (K, BM, W).
B. andersonii: Sikkim: O'Brien cult. s.n. (K); Pantling 300 (CAL n.v.).
B. amplifolium: Bhutan: Balakrishnan 44192 (ASSAM n.v.).
B. apodum: Darjeeling: Pantling 323 (K).
B. appendiculatum: Sikkim: Pantling 197A (BM, K); 197B (AMES, E, NBG); Togashi s.n. (TI).
B. bisetum: Darjeeling: Gamble 9881 (K); Sikkim: Kurzweil 183 (†); Pantling 192A (K, W); 192B (BM).
B. careyanum: Bhutan: Grierson & Long 3585 (E); 3851 (E); Terai: Gamble 10260 (K); Darjeeling: Gamble 154A (K); Kurzweil 154 (KL); Sikkim: Hooker 43A (K-LINDL); Pantling 28A (BM, K, W); 28B (BM, K, W).
B. cariniflorum: Darjeeling: Gamble 10532 (K).
B. cauliflorum var. sikkimense: Darjeeling: Griffith 5165 (K); Sikkim: Hooker 36B (K-LINDL, K); Pantling 221A (BM, K, W); 221B (K); 221C (BM, K, W); 230A (BM, E, K); 230B (BM, K, W); Younghusband s.n. (K).
B. cornu-cervi: Sikkim: Pantling 264 (BM, K).
B. crassipes: Bhutan: Grierson & Long 3311 (E); Terai: Clarke 36904 (K).
B. cylindraceum: Sikkim: Clarke 25226 (K); King 3060 (CAL, icon. K).
B. elatum: Bhutan: Grierson & Long 3235 (E); Darjeeling: Gamble 10457 (K); 10559 p.p. (K); 10560 (K); Sikkim: Clarke 12353 (K); Gamble 9434 (K); Pantling 160 (BM, K, W).
B. emarginatum: Bhutan: Gurung s.n. (Herb. D.B. Gurung).
B. eublepharum: Darjeeling: Clarke 26873 (K, W); Cowan s.n. (E); Gamble 7042 (K); 8266 (K); 10578 (K); Griffith 5296 (K); s.n. (K); Kurzweil 151 (NBG); Sikkim: Pantling 46A (BM, K); 46B (K, W); 46C (NBG).
B. gamblei: Bhutan: Dorji, Pearce & Cribb 72 (E, K, THIM); Duars: Gamble 783A (K); Sikkim: Gamble 8176 (K); Pantling 219A (BM, K, W); 219B (BM, K, W); 219C (NBG).
B. gracilipes. Sikkim: Pantling 242A (BM, K, W); 242B (AMES); 242C (AMES, BM, K, L, NBG, W).
B. griffithii: Bhutan: Dorji, Pearce & Cribb 76 (E, K, THIM); Sikkim: Gammie 1005 (CAL n.v.).
B. guttulatum. Bhutan: Cooper 3321 (BM); Darjeeling: Clarke 9195 (K, W); Griffith 5180 (K); Sikkim: Hooker 32 (K-LINDL); s.n. (K); Pantling 53A (BM, K, W); 53B (K).
B. gymnopus: Bhutan: Griffith 65 (K-LINDL), 5133 (K); Gurung 32 (Herb. D.B. Gurung); Sikkim: Pantling 357 (K, W).
B. helenae: Bhutan: Cooper 3321 (E); Grierson & Long 3572 (E); Sikkim: Pantling 232A (BM, K, W); 232B (NBG).
B. hirtum. Darjeeling: Clarke 9584 (K); 13601 (K); Gamble 4018A (K); Sikkim: Hooker 38A (K-LINDL, K); King's collector s.n. (BM); Pantling 9A (E, W), 9B (BM, K); Chumbi: King's collector s.n. (K).
B. hymenanthum: Bhutan: Cooper 3934 (BM); Sikkim: Clarke 27903 (K); Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Pantling 368A (W); 368B (BM, K).
B. khasyanum: Darjeeling: Gamble 10559 (K); Pantling 239 (BM, K, W); Sikkim: Clarke 25228 (K); s.n. (W); King's collector s.n. (BM); Hooker s.n. (K)
B. leopardinum var. leopardinum: Bhutan: Keith s.n. (E); Murata, Ohashi & Yamazaki 10091 (TI); Sikkim: Pantling 281A (K); 281B (BM, K, W); 281C (BM, K, W).
B. leopardinum var. tuberculatum: Bhutan: Balakrishnan 41971 (CAL n.v.).
B. leptanthum: Sikkim: Pantling 322 (BM, K, W).
B. monanthum: Bhutan: Griffith 138 (K, n.v.).
B. muscicola: Darjeeling: Craib 646-313 (K); Griffith 5178 (K); Sikkim: Hooker s.n. (BM, K, W).
B. odoratissimum var. odoratissimum: Bhutan: Cooper 1238 (BM, E); Dorji, Pearce & Cribb 8 (E, K, THIM); Darjeeling: Gamble 7248 (K); Sikkim: Clarke 2330 (W); Hara, Kanai, Murata, Togashi & Tuyama 1703 (TI); s.n. (TI); Hooker 33 (K-LINDL); s.n. (K); Pantling 16A (BM, E); 16B (K, W) 16C (NBG); Thomson s.n. (E)..
B. odoratissimum var. racemosum: Bhutan: Bowes Lyon 13021 (E); Sikkim: Gamble 10443 (K); Kurz s.n. (BM); Chumbi: King's collector 906 (K)
B. otoglossum: Bhutan: Kanai, Murata, Ohashi, Tanaka & Yamazaki 4138 (TI); s.n. (TI).

B. pantlingii: Sikkim: *Lucksom* 207 (CAL).

B. parviflorum: Bhutan: *Cooper* 3644 (BM).

B. penicillium: Sikkim: *Pantling* 251 (BM, K).

B. piluliferum: Sikkim: *Pantling* 141 (CAL *n.v.*).

B. polyrhizum: Sikkim: *Pantling* 260 (BM, K).

B. reptans: Bhutan. *Dorji, Pearce & Cribb* 74 (THIM); *Grierson & Long* 3239 (E); 4362 (E, K); *Griffith* 31 (K-LINDL). *Ludlow & Sherriff* 1191 (BM, E); *Mokim* s.n. (BM); Darjeeling: *Griffith* 5129 (K); s.n. (W); Sikkim: *Clarke* 13010 (K, W); 14814 (E, K, W); 25308 (BM, K, W); *Pantling* 7A (BM, E, K); 7B (K, W); *Treutler* 980 (K).

B. retusiusculum: Bhutan: *Cooper* 2063 (E); 2296 (BM, E); 2328 (E); 2881 (BM); *Grierson & Long* 4615 (E); *Griffith* 394 (K-LINDL); *Ludlow & Sherriff* 988 (BM); Darjeeling: *Griffith* 5177 (K); s.n. (K-LINDL); *Hooker* 30 (K-LINDL, K); Sikkim· *King* s.n. (BM); *Kirkpatrick* 206 (E); *Pantling* 337 (BM, K, W); *Treutler* 968 (K); 981 (K); *Younghusband* 15 (K).

B. rigidum: Darjeeling: *Clarke* 8775 (K, W); *Gamble* 10512 (K); *Griffith* 5291 (K); Darjeeling/Sikkim: *Gamble* 9761 (K); 8270 (K); Sikkim: *Pantling* 41A (BM, K, W); 42B (AMES, NBG).

B. rolfei: Bhutan: *Grierson & Long* 4488 (E); *Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki* 3535 (TI); 4363 (TI); s.n. (TI); *Kanai, Murata, Ohashi, Tanaka & Yamazaki* 5083 (TI); 8280 (TI); s.n. (TI); Darjeeling: *Griffith* 5174 (K); Sikkim: *Pantling* 342A (BM, K); 342B (BM, E, K, W).

B. rothschildianum: Darjeeling: cult. *O'Brien* s.n. (K).

B. roxburghii: Sikkim: *Pantling* 148A (AMES, L); 148B (K, W); 148C (BM).

B. sarcophylloides: Darjeeling: *Pantling* 95A (BM, K, W); 95D (AMES, BM, K, L, W).

B. sarcophyllum: Sikkim: *Pantling* 95B (BM, K); 95C (AMES, W).

B. scabratum: Bhutan: *Grierson & Long* 4094 (E); Sikkim: *Pantling* 110A (K); 110B (BM, K, W).

B. secundum: Bhutan: *Dorji, Pearce & Cribb* 92 (E, K, THIM); *Gurung* 91 (Herb. D.B. Gurung); Sikkim: *Pantling* 214 A (W); 214B (BM, K, W); 214C (BM, K, W).

B. shweliense: Bhutan: *Gould* 388 (K).

B. spathulatum: Sikkim: *Pantling* 131 A (BM, K); 131B (W).

B. stenobulbon: Duars: *Pantling* 319 (BM, K).

B. sterile: Sikkim: *Pantling* 50A (BM); 50B (K, W); 50C (BM, E, K, W); *Tuyama* s.n. (TI).

B. striatum: Bhutan: *Gurung* 28A (Herb. D.B. Gurung); s.n. (Herb. D.B. Gurung); Sikkim: *Pantling* 298 (K, BM, W).

B. thomsonii: Bhutan: *Cooper* 1239 (BM, E); *Gurung* s.n. (Herb. D.B. Gurung); Darjeeling: *Murata, Togashi & Tuyama* 1705 (TI); Sikkim: *Hara, Kurosawa & Ohashi* s.n. (TI); *King* s.n. (BM); *Pantling* 245A (BM, K, W); 245B (NBG); *Thomson* s.n. (K).

B. tortuosum: Darjeeling: *Pantling* 113 (AMES, BM, K, W).

B. triste: Darjeeling: spec. s.n. (K); Sikkim: *Pantling* 129A (BM, W); 129B (BM, K, W).

B. umbellatum: Bhutan: *Grierson & Long* 4675 (E, K, THIM); *Griffith* s.n. (K-LINDL, W); *Ludlow, Sherriff & Hicks* 20202 (BM); *Gurung* 56 (Herb. D.B. Gurung); *Sinclair & Long* 5691 (E); Sikkim: *Pantling* 208A (BM, W); 208B (BM, W).

B. viridiflorum: Darjeeling: *Clarke* 9537 (K, W); *Gamble* 277 (K); 9992 (K); Sikkim: *King* s.n. (BM); *Pantling* 99A (W); 99B (BM, K); 99C (NBG); *Treutler* 947 (K).

B. wallichii: Bhutan: *Gurung* s.n. (Herb. D.B. Gurung); Sikkim: *Pantling* 24 (AMES, BM, W).

B. yoksunense: Bhutan: *Ludlow & Sherriff* 990 (BM); Darjeeling: *Griffith* 5163 (W); Sikkim: *Gammie* 1223 (BM); *Kirkpatrick* s.n. (E); *Pantling* 303 (BM, K, W).

Bulleyia yunnanensis: Darjeeling: *Gee* s.n. (ASSAM *vide* Kataki & Sastry, 1965).

Calanthe alismifolia: Bhutan: *Cooper* 1067 (BM, E); Terai: *Hooker* s.n. (K); Sikkim: *Gammie* 239 (BM); *Hooker* 239A (K-LINDL, K); s.n. (AMES, BM, W); *Pantling* 316A (K, W); 316B (BM, K); *Thomson* s.n. (E).

C. alpina: Bhutan: *Bowes Lyon* 3198 (BM); 15070 (BM); *Gould* 696 (K); *Ludlow & Sherriff* 227 (BM); 3478 (BM), *Ludlow, Sherriff & Hicks* 19533 (BM, E); *Wood* 5582 (E); 7028 (E, THIM); Sikkim: *Hooker* 245 (K-LINDL, K); s.n. (AMES, BM, K, W); *D. Lang* s.n. (E); *Pantling* 388A (BM, K, W).

C. biloba: Bhutan: *Cooper* 3183 (BM, E); Darjeeling: *Clarke* 9426 (K); 36169 (E); *Gamble* 10581 (K); *Mann* 5 (W); Sikkim: *Gamble* 3993 (BM); *Hooker* 246 (K-LINDL, K); s.n. (AMES, BM, K, W); *Pantling* 56A (BM, K); 56B (W); 56C (NBG); *Treutler* 950 (K); 1155 (K).

C. brevicornu: Bhutan: *Dorji, Pearce & Cribb* 100 (E, THIM); *Gurung* 102 (Herb. D.B. Gurung); Darjeeling: *Anderson* 1216 (W); *Clarke* 11623 (K); *Hara* s.n.(TI); *Murata, Ohashi, Tanaka & Yamazaki* 2855 (TI); s.n. (TI); Sikkim: *Clarke* 46402 (K); *Hooker* 247 (K-LINDL, K); s.n. (K); *King* s.n. (BM); *Pantling* 317A (W); 317B (BM, K).

C. chloroleuca: Bhutan: *Hara* s.n. (TI); s.n. (K, TI); *Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki* 2120 (TI); s.n. (TI); *Kanai, Murata, Ohashi, Tanaka & Yamazaki* 9074 (TI); 10911 (TI); 13245 (TI); s.n. (TI); *Ludlow, Sherriff & Hicks* 18764 (BM, K); 20113 (BM, E); 20509 (BM, K); *Murata, Ohashi & Yamazaki* s.n. (TI); *Tuyama* s.n. (TI); s.n. (TI); Darjeeling: *Hara & Togashi* 1701 (K, TI); *Kanai, Murata, Togashi & Tuyama* 1699 (TI); 1700 (TI); *Yamazaki* s.n. (K, TI); Sikkim: *Hooker* 244 (K-LINDL); s.n. (K); *Treutler* 94 (K).

C. clavata: Darjeeling: *Hooker* s.n. (K); Sikkim: *Hooker* 243 (K); s.n. (BM); *Pantling* 351 (BM, K, W).

C. densiflora: Darjeeling: *Clarke* 36989 (BM, K); Sikkim: *Clarke* 25418 (K); *Treutler* 953 (K).

C. fulgens: Sikkim: *Hooker* 248 (K-LINDL, K); s.n. (K).

C. griffithii: Bhutan: *Grierson & Long* 4604 (E, K, THIM); *Griffith* 33 (K-LINDL, K); s.n. (K-LINDL); s.n. (W); Darjeeling: *Griffith* 5280 (K); Sikkim: *Hooker* s.n. (OXF, W); *Lister* 79 (K); *Pantling* 389A (K); 468B (BM).

C. herbacea: Darjeeling: *Gamble* 10516 (K); Sikkim: *Clarke* 8621 (K); 12320 (K); *Gamble* 10576 (K); *Pantling* 80 (BM, K, W); *Treutler* 537 (K).

C. keshabii: Bhutan: *Grierson & Long* 2692 (E); Sikkim: *Lucksom* 205 (CAL); *Pantling* 388B (E, K).

C. mannii: Bhutan: *Dorji, Pearce & Cribb* 78 (E, K, THIM); *Bowes Lyon* 10096 (E); *Gurung* 97 (Herb. D.B. Gurung); *Kanai, Murata, Ohashi, Tanaka & Yamazaki* 14845 (TI); *Ludlow, Sherriff & Hicks* 20213 (BM); Sikkim: *Pantling* 311 (BM, K, W).

C. odora: Duars: *Pantling* 440 (BM, K, W); Darjeeling: *Yamazaki* s.n. (TI).

C. plantaginea: Bhutan: *Gould* 373 (K); *Grierson & Long* 4215 (E, K, THIM); 4405 (E); *Griffith* s.n. (W); *Gurung* 30 (Herb. D.B.

Gurung); Hara Kanai, Murata, Ohashi, Tanaka & Yamazaki 2121 (TI); 3419 (TI); 3451 (TI); 9963 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 7129 (TI); 9226 (TI); s.n. (TI); Ludlow & Sherriff 1135 (BM); Ludlow, Sherriff & Hicks 18626 (BM); 20175 (BM); Wood 7366 (E); Sikkim: Pantling 468A (K).
C. puberula: Bhutan: Cooper 3292 (BM); 3329 (BM, E); Darjeeling: Cave s.n. (E); Kanai, Ohashi, Hara, Iwatsuki & Ohba 726090 (TI); s.n (TI); Long, McBeath, Noltie & Watson 1053 (E); Pantling 181B (BM); Sikkim: Hooker s.n. (K); Pantling 181A (K); 181C (BM, K, W); Treutler 543 (K)
C. sylvatica: Bhutan: Bowes Lyon 13028 (E); Cooper 2839 (E); Gurung s.n. (Herb. D.B. Gurung); Darjeeling: Clarke 8619 (K); s.n. (K); Sikkim: Hooker 240 (K-LINDL); s.n. (BM, K); King s.n. (BM); Pantling 39 (BM, K, W); Thomson s.n. (E).
C. tricarinata: Bhutan: Bowes Lyon 15011 (BM); Dorji, Pearce & Cribb 90 (E, K, THIM); Gould 319 (K); Grierson & Long 1091 (E, K, THIM); Hara s.n. (TI); Ludlow & Sherriff 3023 (BM); Ludlow, Sherriff & Hicks 18851 (BM, E); 20572 (BM); Sikkim: Pantling 389A (W).
C. triplicata: Bhutan: Bowes Lyon 6101 (BM); Cooper 3293 (E); Dorji, Pearce & Cribb 56 (THIM); Gurung 83 (Herb. D.B. Gurung); Ludlow & Sherriff 3005 (BM); Darjeeling: Clarke 12613 (K).
C. trulliformis: Bhutan: Gurung 104 (Herb. D.B. Gurung); Darjeeling: Kanai, Ohashi, Hara, Iwatsuki & Ohba 726093 (TI); 726094 (TI); Pantling 168B (BM, K); Sikkim: Pantling 168A (AMES, BM, K, W).
C. whiteana: Sikkim: Pantling 365A (W); 365B (BM, K, W).
C. yuksomnensis: Sikkim: Lucksom 311 (CAL).

Cephalanthera damasonium: Bhutan: Bowes Lyon 15004 (BM); Dorji, Pearce & Cribb 67 (E, K, THIM).
C. **erecta** var. **oblanceolata**: Bhutan: Kanai, Murata, Ohashi, Tanaka & Yamazaki 13575 (TI).
C. longifolia: Bhutan: Bartholomew 1572 (E); Bedi 59 (THIM); 139 (THIM); Bowes Lyon 3112 (BM); Cooper 1407 (E); 1525A (E); 3375 (E); Dorji, Pearce & Cribb 34 (E, K, THIM); Gould 68 (K); Grierson & Long 948 (E); 1244 (E); 1843 (E); Griffith 5315 (K); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 15626 (TI); 21707 (K, TI); s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 1326 (TI); Ludlow & Sherriff 58 (BM, E); 3174 (BM); Ludlow, Sherriff & Hicks 16125 (BM, E); 18808 (BM); Umezawa s.n. (TI); Wood 6398 (E); Sikkim: King's collector s.n. (K); Thomson s.n. (W); Chumbi: Bor 19440 (K); Hobson s.n. (K); Bor & Ram 19295 (K); 19633 (K); 20799 (K).

Cephalantheropsis longipes: Sikkim: King s.n. (BM); Pantling 2 (BM, K, W).

Ceratostylis himalaica: Bhutan: Dorji, Pearce & Cribb 91 (E, K, THIM); Griffith 5214 (K); s.n. (K-LINDL); Gurung 41 (Herb. D.B. Gurung); Sikkim: Pantling 149 (BM, K, W).
C. subulata: Sikkim: Pantling 229A (BM, K, W); 229B (K).

Chamaegastrodia asraoa: Bhutan: Broad s.n. (E).

Cheirostylis griffithii: Darjeeling: Pantling 353 (n.v.); Sikkim: Clarke 15711 (W).
C. moniliformis: Bhutan: Griffith 679 (K, OXF); s.n. (K-LINDL, W); Gurung 90 (E); Kanai, Murata, Ohashi, Tanaka & Yamazaki 10787 (TI); 14296 (TI); Ludlow, Sherriff & Hicks 18564 (BM); Sikkim: Hara s.n. (TI).
C. sherriffii: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 18539 (BM).
C. yunnanensis: Sikkim: Luksom 210 (CAL).

Chiloschista parishii: Bhutan: Bowes Lyon 10092 (E); Cooper 3773 (BM); Gurung 61 (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 18525 (BM); Darjeeling: Hara s.n. (TI); McBeath s.n. (E); Pantling 66B (BM, K); Subramanyam s.n. (K); Sikkim: Clarke 27722 (K); Pantling 66A (BM, K, W).
C. usneoides: Bhutan: Gurung s.n. (E); Ludlow & Sherriff 2959 (BM); Ludlow, Sherriff & Hicks 20544 (BM, K); Sikkim: Hooker 192 (K-LINDL); s.n. (K).

Chrysoglossum ornatum: Darjeeling: Clarke 12314 (W); Sikkim: Pantling 83 (BM).

Chusua chrysea: Bhutan: Ludlow, Sherriff & Hicks 19418 (E); 21343 (E); Miehe 00-191-04 (MB).
C. nana: Bhutan: Miehe 00-142-01 (MB); Sikkim: Pantling 326 (AMES, K); Chumbi: King's collector 4444 (K).
C. pauciflora: Bhutan: Bedi 395 (K); 623 (K); Cooper 1889 (BM, E); 2530 (E); 2689 (BM, E); Dorji & Nawang s.n. (THIM); Gould 495A (K); 1153 (K); 1250 (K); Grierson & Long 2750 (E, K, THIM, TI); Gurung 17 (Herb. D.B. Gurung); Hara, Kurosawa & Chuma s.n. (TI); Long, McBeath, Noltie & Watson 405 (E); 599 (E); Ludlow, Sherriff & Hicks 16866 (E); 19129 (E); 19271 (E); 19486 (E); 20409 (BM); 20441 (E); Miehe 00-119-03 (MB); 00-151-12 (MB); 00-165-28 (MB); 00-254-02 (MB); Noltie 5 (E); Sinclair & Long 5108 (E); Sargent 33 (E); 81 (E); 92 (E); 111 (E); Wood 6492 (E); 7008 (E, THIM); Darjeeling/Sikkim: Kanai, Ohashi, Hara, Iwatsuki & Ohba s.n.(TI); Sikkim: Cave 77/47 (E); Cooper 292 (E); Elwes s.n. (K); Hooker 284 (K-LINDL, K); 289 (K-LINDL); s.n. (BM, K, OXF, W); King 4441 (K); King's collector s.n. (K); Long, McBeath, Noltie & Watson 405 (E); 599 (E); Long & Noltie 308 (E); Lowndes 611 (E); 750 (E); Pantling 458A (BM, K, W); 458B (BM, E, K, W); 458C (BM, K, W); Rohmoo 150 (E); 850 (E); 1020 (E); 1123 (E); Starling, Upward, Brickell & Mathew 136 (K); Wager 319 (K); 331 (K); Younghusband 199 (K); s.n. (K); Chumbi: Bell s.n. (K); Dungboo 4278 (K); s.n. (E, K, W); s.n. (K); Gould 831 (K); Pantling 326 (BM, L, W); Bor & Ram 20184 (K); 20308 (K); 20527 (K); s.n (K); Spencer Chapman 288 (K); 362 (K); 375 (K); 801 (K); 820 (K); 828 (K); 846 (K).
C. puberula: Bhutan: Chauhan 172 (TI); Gould 583 (K); 592 (K); Grierson & Long 1799 (E); Gurung s.n. (E); Sikkim: King's collector s.n. (K); Long & Noltie 204 (E); Pantling 478 (AMES, K, W).

Cleisocentron pallens: Sikkim: Pantling 92A (K, W); 92B (K).

Cleisostoma aspersum: Bhutan: Murata, Ohashi & Yamazaki s.n. (TI); Sikkim: Pantling 178 (BM, K, W).
C. discolor: Darjeeling: Gamble s.n. (CAL, icon.K).
C. filiforme: Darjeeling: Griffith 5246 (K); Sikkim: Kurzweil 189 (K); Pantling 52 (BM, K, W).
C. linearilobatum: Bhutan: Grierson & Long 4562 (E).

C. racemiferum: Bhutan: Bowes Lyon 13030 (E); Dorji, Pearce & Cribb 65 (E, K, THIM); Grierson & Long 4243 (E). Hara, Kanai, Murata Ohashi, Tanaka & Yamazaki 14505 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 36 (TI); Sinclair & Long [illegible] (E); Sikkim Gamble 9687 (K); Hara, Kanai, Murata, Togashi & Tuyama 3283 (K, TI); Pantling 43 (BM, K, W).

C. simondii: Sikkim: Pantling 241A (BM, K, W); 41B (K).

C. striatum: Darjeeling: Gamble 10452 (K); Macleary & Green 728 (W); Sikkim: Pantling 175A (BM, K, W); 175B (BM, K, W); 175C (NBG).

C. subulatum: Bhutan: Grierson & Long 3604 (E); Sikkim: Pantling 151A (BM, K); 151B (BM, E, K, W).

C. williamsonii: Bhutan: Dorji, Pearce & Cribb 22 (E, K, THIM); 54 (E, THIM); Gurung s.n. (Herb. D.B. Gurung); Ludlow & Sherriff 3007 (BM, E).

Coeloglossum viride: Bhutan: Ludlow, Sherriff & Hicks 20321 (BM, E).

Coelogyne assamica: Bhutan: Foerstermann 9 (W).

C. barbata: Bhutan: Broad s.n. (E); Grierson & Long 3127 (E); 3255 (E); 4040 (E); Griffith s.n. (K).

C. corymbosa: Bhutan: Dorji, Pearce & Cribb 33 (E, THIM); Gould 305 (K); Grierson & Long 3022 (E); 3029 (E); 3078 (E), 3669 (E, K, THIM); 4617 (E); Griffith 5098 (K); Gurung 85 (Herb. D.B. Gurung); Hara s.n. (TI); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki s.n. (TI); s.n. (TI); s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 2597 (TI); 8389 (TI); 13029 (TI); s.n. (K, TI); s.n. (TI); Kanai & Yamazaki 5973 (TI); Ludlow & Sherriff 2954 (BM); Ludlow, Sherriff & Hicks 16357 (BM, E); 20119 (BM); Sinclair 4175 (E); Darjeeling: Cave s.n. (E); Chamberlain C7500 (E); Clarke 35630 (BM); Gamble 8062 (K); Griffith 5099 (K); Kanai, Murata, Togashi & Tuyama 1694 (K, TI); Lace s.n. (E); Sikkim: Hooker 134 (K); 136 (K-LINDL); s.n. (E, K); King s.n. (BM); Lacaita 16272 (BM); Pantling 7 (BM, K, W); Treutler s.n. (K).

C. cristata: Bhutan: Gurung 38 (Herb. D.B. Gurung); Grierson & Long 4554 (E, THIM); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 3709 (TI); 3807 (TI); Darjeeling: Gamble 556 (K); 3980 (K); 7045 (K); 10306 (K); Griffith 5106 (K); s.n. (K-LINDL); Hara & Togashi 1697 (TI); s.n. (TI); Lacaita 16273 (BM); Lister s.n. (BM); Low s.n. (W); Murata & Togashi s.n. (TI); Schlagintweit 12485 (BM); Sinclair 4245 (E); Sikkim: Clarke 2491 (W); 27888 (BM); Hooker 132 (K-LINDL); s.n. (BM, E, K, OXF, W); Ludlow, Sherriff & Taylor 4027 (BM, E); Pantling 104A (E, K); 104B (BM, K).

C. fimbriata: Bhutan: Dorji, Pearce & Cribb 47 (E, THIM); Gould 663 (K); Griffith 5158 (K); Kanai, Murata, Ohashi, Tanaka & Yamazaki 7074 (TI); 7096 (TI); Ludlow & Sherriff 1048 (BM); Darjeeling: Berkeley s.n. (K); Gamble 4017 (K); 9981 (K); Sikkim: Clarke 25145 (K, W); Hooker 127A (K-LINDL); s.n. (K); Pantling 19A (BM, K); 19B (BM, K); Thomson s.n. (E).

C. flaccida: Bhutan: Grierson & Long 3579 (E); 4122 (E, K, THIM); Darjeeling: Cave s.n. (E); s.n. (E); s.n. (E); Griffith 5092 (K); Sikkim: Hooker s.n. (K); Pantling 123C (BM, K, W).

C. fuscescens var. **fuscescens**: Bhutan: Cooper 3643 (BM, E); Grierson & Long 3586 (E); Darjeeling: Clarke 9544 (BM); 9547 (K); 9770 (BM); Griffith 5198 (K); Hooker s.n. (K); Treutler 1148 (K); Sikkim: Cave s.n. (E); Hara s.n. (TI); Hooker 135 (K-LINDL); s.n. (BM, OXF); Pantling 22 (BM).

C. longipes: Bhutan: Bowes Lyon 9121 (E); Sikkim: Ghose H3633/61 (K).

C. nitida: Bhutan: Dorji, Pearce & Cribb 15 (E, THIM); Grierson & Long 1365 (E, K, THIM); Griffith 24 (K-LINDL); 25 (K-LINDL); 5097 (K); Ludlow & Sherriff 2930 (BM); Darjeeling: Clarke 11515 (BM); 12009 (BM); 26650 (W); 35175 (BM, W); s.n. (K); Gamble 7168 (K); 8114 (K); Griffith 5096 (K); s.n. (K-LINDL); Hara, Kanai, Murata, Togashi & Tuyama 1688 (TI); 1689 (TI); 1690 (TI); Hooker s.n. (K); Lace 2228 (E, K); Swinton s.n. (K); Sikkim: Clarke 27661 (BM); Gamble 6907 (K); Hooker 138 (K-LINDL); s.n. (E, K, W); s.n. (BM, OXF); Lacaita 16270 (BM); 16268 (BM); Pantling 76A (E, K, W); 76B (BM, K, W); Thomson s.n. (E); Townend 1 (OXF).

C. occultata var. **occultata**: Bhutan: Dorji, Pearce & Cribb 45 (E, THIM); 49 (E, K, THIM); Gould 618 (K); Gurung 105 (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tuyama & Yamazaki 3406 (TI); 3484 (TI); Kanai, Murata, Ohashi, Tuyama & Yamazaki s.n. (TI); Miehe 00-022-40 (MB); Ludlow & Sherriff 243 (BM); Darjeeling: Gamble 8062 (K); Griffith 5159 (K); Kurzweil 153 (NBG); Sikkim: Hooker s.n. (K); Pantling 213A (W); 213 (BM, K, W).

C. ovalis: Bhutan: Grierson & Long 3461 (E); 4223 (E); Gurung 27 (Herb. D.B. Gurung); Darjeeling: Cowan s.n. (E); Sikkim: Pantling 19 (W).

C. prolifera: Bhutan: Cooper 1240 (BM, E); Gurung s.n. (Herb. D.B. Gurung); Darjeeling: Clarke 11812 (BM, K); Cowan s.n. (E); Gamble 10354 (K); Griffith 5094 (K); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1693 (TI); Hooker 128A (K-LINDL); s.n. (K, W); Pantling 29A (BM, E, K, W); 29B (BM, K, W).

C. punctulata: Sikkim: Bowes Lyon 3016 (BM); Thomson s.n. (E).

C. raizadae: Bhutan: Bowes Lyon 3291 (BM); Dorji, Pearce & Cribb 80 (E, K, THIM); 84 (E, K, THIM); Sikkim: Clarke 46427 (K); Dungbao s.n. (K); Pantling 128A (E, K); 128B (BM, K, W); 128C (E, NBG); Treutler 208 (K).

C. schultesii: Bhutan: Dorji, Pearce & Cribb 60 (E, K, THIM); Bowes Lyon 9120 (E); 9122 (E); Grierson & Long 3694 (E); Sikkim: Clarke 46432 (K); Pantling 366A (W); 366B (E); 366C (BM, K, W).

C. stricta: Bhutan: Cooper 3637 (E); Grierson & Long 4120 (E, K, THIM); 4238 (E); 4565 (E); Griffith 46 (W); 5105 (E, K, NY); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 4623 (TI); 13649 (TI); s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 1452 (TI); 3248 (TI); 3631 (TI); 3635 (TI); Ludlow & Sherriff 2939 (BM); Ludlow, Sherriff & Hicks 18573 (BM); Darjeeling: Clarke 27479 (K); Gamble 10332 (K); Griffith s.n. (W); Sikkim: Hooker 125 (K-LINDL); s.n. (K, W); Pantling 123A (E); 123B (W); 123C (BM, K).

Corybas himalaicus: Bhutan: Gurung 5 (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 20481 (BM, E); Miehe 00-116-21 (MB); Sikkim: Pantling 385A (AMES, BM, E, K, W); 385B (AMES, BM, L, W).

Corymborkis veratrifolia: Sikkim: Hooker 58 (K-LINDL); s.n. (BM, K, W); Pantling 475 (BM, K, W).

Cremastra appendiculata var. **appendiculata**: Bhutan: Ludlow & Sherriff 2946 (BM); Ludlow, Sherriff & Hicks 20212 (BM); Wood 6294 (E); Darjeeling: Gamble 4011A (K); Griffith 5204 (K); s.n. (W); Kanai, Murata, Togashi & Tuyama 1692 (TI); Lacaita s.n. (BM); Lace 2226 (E, K); s.n. (E); Treutler 69 (K); Sikkim: Clarke 13595 (BM, W); 27681 (K, W); 27863 (K, W); Hooker 242 (K-LINDL, K); s.n. (K); Pantling 142A (K, W); 142B (BM, K).

CHECKLIST OF SPECIMENS EXAMINED

Cryptochilus lutea: Bhutan: Gould 669 (K); Grierson & Long 2240 (E, K, THIM); Griffith 5228 (K); Gurung 108 (Herb. D.B. Gurung); Darjeeling: Gamble 737 (K); 10348 (K); Griffith 5229 (K); s.n. (K-LINDL); Kanai, Ohashi, Hara, Iwatsuki & Ohba 726119 (TI); Sikkim: Gammie s.n. (K); Pantling 86 (BM, K).
C. **sanguinea**: Darjeeling: Gamble 8283 (K); 10458 (K); 10492 (E, K); Sikkim: Hooker 200 (K-LINDL); s.n. (K); Long, McBeath, Noltie & Watson 125 (E); Pantling 36A (BM); 36B (K).

Cymbidium aloifolium: Darjeeling: Kanai, Murata & Togashi s.n. (TI); Sikkim: Clarke 11811 (BM, K, W); Gamble 9433 (K); Hooker 236 (K); s.n. (K); Pantling 268A (K); 268B (BM, K, W).
C. **bicolor** subsp. **obtusum**: Bhutan: Grierson & Long 3460 (E); Ludlow & Sherriff 1200 (BM); Sikkim: Hooker 228 (K, K-LINDL); Pantling 441A (BM, K):441B (W).
C. **cochleare**: Darjeeling: Pantling 352 (K); Sikkim: Hooker 235 (K-LINDL, K).
C. **cyperifolium** subsp. **cyperifolium**: Bhutan: Cooper 3181 (BM); Griffith s.n. (K-LINDL, W); Ludlow & Sherriff 1124 (BM); Sikkim: Anderson 1257 (W); Pantling 306 (BM, K).
C. **dayanum**: Bhutan: Dorji, Pearce & Cribb 39 (E, THIM); Sikkim: Pantling 51A (BM); 51B (AMES, K, W).
C. **devonianum**: Darjeeling: Gamble 10333 (K); Kanai, Murata, Ohashi, Tanaka & Yamazaki 1079 (TI); Subramanyam s.n. (K); Sikkim: Hooker s.n. (K); s.n. (K); Pantling 265 (BM, K, W).
C. **eburneum**: Darjeeling: Clarke 13971 (K); Mann 41 (W); Sikkim: Pantling 108A (BM, K, W); 108B (BM, K).
C. **erythraeum**: Bhutan: Broad s.n. (E); Sinclair & Long 5660 (E); Darjeeling: Clarke 9546 (K); Gamble 1982 (K); 9996 (K); 10008 (K); Griffith 5268 (K); Sikkim: Gamble 7285 (K); Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Hooker 229 (K-LINDL); s.n. (AMES, K); Pantling 8A (K); 8B (W).
C. **faberi** var. **szechuanicum**: Bhutan: Gurung s.n. (Herb. D.B. Gurung).
C. × **gammieanum**: Sikkim: Pantling 299A (W); 299B (BM, NBG).
C. **goeringii** var. **goeringii**: Bhutan: Gurung s.n. (E, Herb. D.B. Gurung); s.n. (Herb. D.B. Gurung).
C. **hookerianum**: Bhutan: Bailey s.n. (E); Grierson & Long 3068 (E); Griffith 14 (K); s.n. (AMES); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 11297 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 2643 (TI); 5091 (TI); 8272 (TI); s.n. (TI); Kanai & Yamazaki 5994 (TI); Kingdon Ward 6427 (K); Ludlow & Sherriff 2975 (BM); Ludlow, Sherriff & Hicks 20511 (BM, E); Darjeeling: Clarke 27043 (K); Gamble 4007 (K); Griffith 5265 (K); s.n. (K-LINDL); Hooker s.n. (K); Kanai, Murata, Togashi & Tuyama 1686 (TI); Sikkim: Hooker 227 p.p. (K-LINDL); Lister s.n. (BM); Pantling 63A (BM, K, W); 63B (BM, K, W).
C. **iridioides**: Bhutan: Cooper 3661 (E); Griffith 55 (W); Ludlow & Sherriff 1108 (BM); Darjeeling: Clarke 9482 (K); 4550 (BM); 27040 (W); Gamble 9914 (K); Hooker 227 p.p. (K, K-LINDL); Sikkim: Hooker 233 (K-LINDL); s.n. (W); Pantling 12 (BM, K, W).
C. **lancifolium**: Bhutan: Cooper 2864 (BM, E); Gurung 42 (Herb. D.B. Gurung); Sikkim: Pantling 75A (BM, K); 75B (W).
C. **longifolium**: Bhutan: Grierson & Long 3145 (E); Gurung 54 (Herb. D.B. Gurung); s.n. (Herb. D.B. Gurung); Ludlow & Sherriff 1051 (BM); 1116 (BM, E); Ludlow, Sherriff & Hicks 21249 (BM, E); Darjeeling: Clarke 9482 (W); 9546 (W); 9550 (W); 36089 (BM); Gamble 2056 (K); Griffith 5262 (K); s.n. (K-LINDL, W); Kuntze 6710 (W); 6711 (W); Sikkim: Clarke 9408 (K, W); 9594 (K, W); 25144 (BM, W); Gamble 25144 (K); Hara, Kanai, Murata, Togashi & Tuyama 1687 (TI); s.n. (TI); Hooker 232 (K-LINDL, K); s.n. (BM, K, OXF, W); Pantling 14A (K, W); 14B (NBG).
C. **macrorhizon**: Darjeeling: Kurzweil 144 (K); Pradhan 22 (K).
C. **mastersii**: Bhutan: Grierson & Long 4242 (E); Darjeeling: Pantling 101 (W).
C. **munronianum**: Bhutan: Gurung 45 (Herb. D.B. Gurung); Duars: Haines 595 (K); Pantling 256B (K, W); Darjeeling: Cowan s.n. (E, K), Sikkim: Pantling 256A (AMES); 256C (BM, K).
C. **whiteae**: Sikkim: Pantling 425A (BM, W); 425B (K).

Cypripedium cordigerum: Bhutan: Bedi 49 (K, THIM); Bowes Lyon 3312 (E); Cooper 3909 (E); Dorji, Pearce & Cribb 88 (THIM); Gould 64 (K);110 (K); Grierson & Long 113 (E); 1875 (E); Ludlow & Sherriff 70 (BM); 3122 (BM, E); Ludlow, Sherriff & Hicks 19076 (BM, E); Wood 6397 (E); Chumbi: Gould 2091 (K); Walsh 72 (K).
C. **elegans**: Bhutan: Bowes Lyon 3419 (BM); 15047 (BM); Ludlow & Sherriff 3193 (BM); Ludlow, Sherriff & Hicks 16386 (BM); 19134 (BM); Miehe 00-160-31 (MB); Pradhan 128 (THIM); Sikkim: Clarke 46582 (K); Pantling 387A (BM, W); 387B (E, K, W).
C. **guttatum**: Bhutan: Gould 142 (K); King's collector 452 (K); Ludlow & Sherriff 82 (BM); Ludlow, Sherriff & Taylor 5031 (E); Chumbi: Bailey s.n. (E); Bor & Ram 20347 (K); Gould 2092 (K); King's collector s.n. (K); Walsh 42 (K).
C. **himalaicum**: Bhutan: Bedi 383 (K, THIM); Bowes Lyon 3370 (BM); 3458 (BM); 9009 (E); Cooper 1794 (E); 4001 (BM); Gould 483 (E); 546 (K); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 7405 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 6195 (TI); 6607 (TI); s.n. (TI); Ludlow, Sherriff & Hicks 16603 (BM, E); 19131 (BM); 20754 (BM, E); Miehe 00-119-27 (MB); 00-152-13 (MB); 00-200-11 (MB); Nishioka s.n. (TI); Sinclair & Long 5332 (E); Sikkim: Hooker 317 (K); s.n. (BM, E, OXF, W); Pantling 373A (BM, E, W); 373B (BM, K, W); Chumbi: Dungboo s.n. (E); King's collector 614 (E).
C. **tibeticum**: Bhutan. Bowes Lyon 3413 (BM); Chauhan 140 (TI); Cooper 4001 (E); Dorji & Nawang s.n. (THIM); Gould 477 (K); Gurung 66 (Herb. D.B. Gurung); Ludlow & Sherriff 162 (BM, E); 3233 (BM); Ludlow, Sherriff & Hicks 16325 (BM, E); 18970 (BM, E); 19123 (BM, E); Pradhan 44 (THIM); Sikkim: Pantling 386A (BM, K, W); 386B (AMES, BM, W); Chumbi: Dungboo s.n. (K).

Dendrobium aduncum: Bhutan: Grierson & Long 3602 (E); Darjeeling: Lister s.n. (K); Sikkim: Pantling 272A (BM, K); 272B (K, W); 272C (BM).
D. **amoenum**. Darjeeling Cave s.n. (E); Clarke 11684 (K); 27983 (K); 35553 (K); Gamble 7043 (K); Sikkim: Anderson 1194 (W); Hooker s.n. (K); Kurz s.n. (BM); Pantling 267A (K); 267B (BM, E, K, W).
D. **anceps**: Darjeeling. Gamble 7286 (K); Hara, Kanai, Murata, Togashi & Tuyama 1684 (TI); Ohtsuka s.n. (TI); Schlagintweit 12609 (BM); Sikkim. Hooker 14 (K-LINDL); s.n. (K, W); Pantling 258A (K, W); 258B (BM, K, W).
D. **aphyllum**: Bhutan: Grierson & Long 3488 (E); 3734 (K, THIM); 3880 (E, K, THIM); Gurung 49 (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 2071 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 300 (TI); 14108 (TI); 14267 (TI); 14290 (TI); 14298 (TI); 14301 (TI); Ludlow & Sherriff 2024 (BM); Ludlow, Sherriff & Hicks 18580 (BM); Terai: Cave s.n. (E); Subramanyam s.n. (K); Darjeeling: Clarke 27083 (W); 43265 (W); Hara s.n. (TI); Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Hooker s.n. (K); s.n. (K);

Sikkim: Clarke 27619 (K, W), Hooker 4 (K-LINDL); 5 (K-LINDL); 154 (K-LINDL); Lacaita 15521 (BM); 15552 (BM); s.n. (BM) Lister 88 (K); Pantling 70A (BM), 70B (BM, K, W); Townend 2 (OXF); Treutler 29 (K).

D. bicameratum: Bhutan: Strickland s.n. (K); Darjeeling: Gamble 8273 (E); 10510 (K); Treudel 575 (C) (*vide* Seidenfaden, 1985); Sikkim: Clarke 12268 (K, W); Pantling 40A (BM, K); 40B (K).

D. candidum: Bhutan: Dorji, Pearce & Cribb 30 (E, K, THIM); Grierson & Long 3067 (E); 3234 (E). Griffith 1013 (K-LINDL); s.n. (W), Gurung s.n. (E); Ludlow & Sherriff 3135 (BM); ex herb. Richard 1013 (W). Darjeeling: Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Sikkim: Clarke 46662 (BM, K); Hara, Kanai, Murata, Togashi & Tuyama 1685 (TI); s.n. (TI); Hooker 143 (K-LINDL, K); King's collector s.n. (K); Pantling 367A (BM, K, W); 367B (BM, E, K, W); 367C (K, W).

D. cathcartii: Bhutan. Grierson & Long 3616 (E); Darjeeling: Pantling 114B (BM); 114C (BM, K); Sikkim: Pantling 114A (E, K, W), 114D (NBG).

D. chrysanthum: Bhutan: Bigger 3008 (E); Cooper 3033 (BM, E); Gurung 21 (Herb. D.B. Gurung); Grierson & Long 3153 (E); 4537 (E); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 1935 (E, TI); Sinclair & Long 5621 (E). Darjeeling: Cave s.n. (E); Clarke 12240 (K, W); Gamble 924 (K); 976 (K); 9650 (K); 10550 (K); Griffith 5062 (K); s.n. (K-LINDL); Hara, Kanai, Murata, Togashi & Tuyama 1676 (TI); Kanai, Ohashi, Hara, Iwatsuki & Ohba 721530 (TI); Sikkim: Clarke 25124 (BM, W); Hara, Kanai, Murata, Togashi & Tuyama 1675 (TI); s.n. (TI); Hooker 13 (K-LINDL); s.n. (BM, K, OXF, W); Pantling 10A (K, W); 10B (BM, K, W); Treutler s.n. (K)

D. crepidatum: Sikkim: Pantling 308A (K); 308B(K, W).

D. cumulatum: Bhutan: Lister 1 (K); Darjeeling: Mann 40 (W); Sikkim: Pantling 276A (W); 276B (BM, K); s.n. (BM, probably unnumbered 276A).

D. darjeelingense: Darjeeling: Pradhan's collectors (Herb. Pradhan, *n v.*).

D. densiflorum: Bhutan: Dorji, Pearce & Cribb 62 (E, K, THIM); Grierson & Long 4206 (E); Kanai, Murata, Ohashi, Tanaka & Yamazaki 14107 (TI); 14288 (TI); s.n. (TI); Ludlow & Sherriff 2927 (BM); Darjeeling: Clarke 9193 (W); Gamble 716A (K); 7044 (K), Griffith 21 (W); 5064 (K); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1683 K, TI); s.n. (TI); Hooker 7 (K-LINDL); 150 (K-LINDL); s.n. (K, W); Lacaita 738 (BM); 748 (BM); Pantling 119 (BM, K, W).

D. denudans: Bhutan: Grierson & Long 4152 (E); Darjeeling: Clarke 9236 (W); 9245 (BM); 13599 (W); Gamble 9879 (K); Griffith 5153 (K); Sikkim: Anderson 1196 (BM, E, W); Clarke 9969 (BM, W); 13504 (K); 25070 (K, W); 25122 (K, W); Hooker 20 (K-LINDL); s.n. (K); Mann 1 (W); Pantling 4 (BM, K, W); Treutler 916 (K).

D. devonianum: Bhutan: Bowes Lyon 3206 (BM); Dorji, Pearce & Cribb 26 (E, THIM); 85 (E, K, THIM); 98 (THIM); Griffith 29 (K-LINDL); 5060 (K); s.n. (W); Kanai, Murata, Ohashi, Tanaka & Yamazaki 4295 (TI).

D. eriiflorum: Bhutan: Cooper 2067 (BM, E); 2076 (BM, E); Gurung s.n. (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 19660 (BM, E); Sinclair & Long 5772 (E); Darjeeling: Cowan s.n. (E); Gamble s.n. (K); Sikkim: Craib 634-160 (K); King's collector s.n. (BM); Pantling 194A (BM, K, W); 194B (E).

D. falconeri: Bhutan: Bowes Lyon 3324 (BM); 6115 (BM); Dorji, Pearce & Cribb 66 (E, THIM); Gould 394 (K); 637 (K); Grierson & Long 1666 (E, K, THIM, TI); Kanai, Murata, Ohashi, Tanaka &Yamazaki 7085 (TI); 11302 (TI); Ludlow & Sherriff 567 (BM, E); 3143 (BM).

D. farmeri: Sikkim: Pantling 116A (BM, K, W); 116B (W); 116C (BM, K).

D. fimbriatum: Bhutan: Dorji, Pearce & Cribb 59 (E, K, THIM); Gould 277 (K); Grierson & Long 3501 (E); 3953 (E, THIM); Ludlow & Sherriff 581 (E); Darjeeling: Gamble 10336 (K); Sikkim: Egerod B-117 (K, UC); Lacaita 745 (BM); Pantling 360A (W); 360B (BM, K, W).

D. formosum: Sikkim: Pantling 271 (BM, K, W).

D. gibsonii: Bhutan: Dorji, Pearce & Cribb 20 (E, K, THIM); Grierson & Long 1313 (E, K, THIM); Sikkim: Hooker 12 (K-LINDL); s.n. (K, OXF); Pantling 334A (BM, K); 334B (BM, K); 334C (W); Younghusband s.n. (K).

D. heterocarpum: Bhutan: Gurung s.n. (Herb. D.B. Gurung); s.n. (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki s.n. (TI); Ludlow & Sherriff 1132 (BM); Murata, Ohashi & Yamazaki 10073 (BM, TI): Sikkim: Hara s.n. (TI); Pantling 200A (BM, K, W).

D. hookerianum: Bhutan: Bigger 3007 (E); Cooper 2077 (E); Ludlow & Sherriff 581 (BM): 945 (BM): Darjeeling: Clarke 12315 (K, W); Gamble 9700 (K); 10574 (K); Griffith 5053 (K); 5063 (K); Pantling 296C (W); Sikkim: Hooker 8 (K-LINDL): s.n. (K); King 187 (BM); Pantling 296A (K, W); 296B (BM, K); 296D (NBG).

D. jenkinsii: Bhutan: Bowes Lyon 10024 (E); Dorji, Pearce & Cribb 7 (E, K, THIM); Grierson & Long 4512 (E); Kanai, Murata, Ohashi, Tanaka & Yamazaki 10504 (BM, TI); 14294 (BM, TI); Murata, Ohashi & Yamazaki 10150 (TI); Wood 7248 (E): Terai: Pantling s.n. (W); Duars: Pantling 262 (BM, K, W).

D. longicornu: Bhutan: Broad s.n. (E); Cooper 2381 (E); 3611 (BM, E); Gurung 22 (Herb. D.B. Gurung); Kanai, Murata, Ohashi, Tanaka & Yamazaki 5082 (TI); 5365 (TI); 7088 (TI); 11136 (TI); Ludlow & Sherriff 932 (BM); Ludlow, Sherriff & Taylor 6755 (BM, E); 7220 (BM, E); Sinclair & Long 5663 (E); Darjeeling: Clarke 9536 (K); 36347 (BM); 36470 (W); Cowan s.n. (E, K); Craib 615-98 (K); Gamble 278 (K); 7280 (K); 9882 (K); Griffith s.n. (W); Togashi 1681 (TI); Sikkim: Anderson 1229 (W); Clarke 25230 (K); 25311 (K); 25339 (BM, K, W); 25375 (BM, W); Gammie 1250 (BM); Hara s.n. (K, TI); Hooker 10 (K-LINDL); s.n. (K, W); Kirkpatrick 202 (E); Pantling 15 (BM, E, K, W).

D. moschatum: Bhutan: Cooper 1050 (BM, E); Gurung s.n. (E); Darjeeling: Gamble 9440 (K); 9643 (K); Sikkim: Pantling 370A (K, W); 370B (BM, K, W).

D. nobile: Bhutan: Cooper 1243 (BM, E); Dorji, Pearce & Cribb 55 (THIM); Grierson & Long 3643 (E); 4555 (E, K, THIM); Griffith 940 (K-LINDL); Gurung 53 (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14679 (TI); 14694 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 13632 (TI); 13634 (TI); 14417 (TI); Ludlow & Sherriff 2957 (BM); Ludlow, Sherriff & Hicks 20170 (BM, E); Darjeeling: Griffith 5054 (K); s.n. (K-LINDL); Sikkim: Clarke 27609 (K, W); 27700 (K); Hara, Kanai, Murata, Togashi & Tuyama 1682 (TI); Hooker s.n. (BM,E, K, OXF, W); Lacaita 740 (BM); Pantling 362A (BM, K, W); 362B (BM, K, W).

D. peguanum: Terai: Anderson icon (K); Darjeeling: Clarke s.n. (K); Sikkim: Pantling 23A (K, W); 23B (BM).

D. porphyrochilum: Darjeeling: Murata, Togashi & Tuyama 1674 (TI); Pantling 363B (BM, K, W); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Hooker s.n. (K); Kurzweil 173 (K); Pantling 320 (K); 363A (BM, K, W).

D. praecinctum: Bhutan: Grierson & Long 4104 (E); Sikkim: Pantling 172A (W); 172B (BM, K, L, W); 172C (BM, K).

D. ruckeri: Darjeeling: Lister s.n. (K); Sikkim: Pantling 117A (W); 117B (K); 117C (BM).

D. spatella: Bhutan: Dorji, Pearce & Cribb 41 (THIM); Gurung s.n. (Herb. D.B. Gurung).

D. stuposum: Sikkim: Pantling 84A (BM); 84B (K).

D. sulcatum: Darjeeling: Gamble 10501 (K); Sikkim: Pantling 138 (BM, K, W).
D. terminale: Bhutan: Grierson & Long 3593 (E); Sikkim: Pantlng 236 (BM, K, W).
D. transparens: Bhutan: Gurung 72 (Herb. D.B. Gurung); 99 (Herb. D.B. Gurung); Ludlow & Sherriff 2925 (BM); Sinclair & Long 5773 (E); Darjeeling: Griffith 5059 (K); Sikkim: Hooker 153 (K-LINDL); Pantling 79 (BM, E, K, W).

Dickasonia vernicosa: Bhutan: Gould 622 (K).

Didiciea cunninghamii: Sikkim: Cunningham s.n. (CAL); Pantling 396 (BM, CAL, K, W).

Didymoplexis pallens: Darjeeling: Kurzweil 141 (W); Sikkim: Pantling 146A (W); 146B (BM, K).

Diglyphosa latifolia: Darjeeling: Pantling 315 (AMES, BM).

Diphylax urceolata: Bhutan: Ludlow & Sherriff 967 (BM); Wood 7173 (E); Darjeeling: Pantling 347 (BM, K); Sikkim: Cave 92 (K); Clarke 10244 (K); Ribu & Rohmoo 6442 (E).

Diplomeris hirsuta: Terai: Biswas s.n. (K); Darjeeling: King's collector s.n. (BM); Pantling 184 (BM, K, W).

Diploprora championii: Darjeeling: Gammie s.n. (K); Pradhan 1 (K); 2 (K); Sikkim: Pantling 284A (BM, K); 284B (W).

Epigenium amplum: Darjeeling: Gamble 9880 (K); Grierson & Long 4552 (E); 4556 (E); Sikkim: Clarke 9771 (BM, W); 13505 (BM, W); 25179 (K, W); Hooker 22 p.p. (K-LINDL); s.n. (BM, K, W); Pantling 246A (W); 246B (BM, K, W).
E. fuscescens: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 3488 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 5371 (TI); Ludlow & Sherriff 1068 (BM); Ludlow, Sherriff & Hicks 21256 (BM, E); Darjeeling: Clarke 9541 (K, W); Pantling 11A (BM, K); Sikkim: Clarke 25393 (W); Gammie 1230 (E); Pantling 11B (E, NBG).
E. navicularis: Bhutan: Balakrishnan 43014 (CAL, K photo.); Grierson & Long 4010 (E).
E. rotundatum: Bhutan: Grierson & Long 3152 (E); Ludlow & Sherriff 2947 (BM); Murata, Ohashi & Yamazaki 19901 (TI); s.n. (TI); Darjeeling: Chamberlain 41 (E); Griffith 5160 (K); 5161 (K); Hara 1691 (TI); s.n. (TI); Lacaita s.n. (BM); Sikkim: Hooker 24 (K-LINDL); s.n. (BM, K, W); Lister s.n. (E, W); Pantling 69A (BM, K); 69B (W); Treutler 93 (K).
E. treutleri: Sikkim: Treutler s.n. (K).

Epipactis helleborine: Bhutan: Bedi 806 (K, THIM); 1070 (K, THIM); Cooper 1525 (E); 2726 (E); 3381 (E); Gurung s.n. (E); Ludlow, Sherriff & Hicks 16662 (BM, E); 19487 (BM); Miehe 00-254-01 (MB); 00-351-02 (MB); Sinclair & Long 5092 (E); Wood 5654 (E, THIM); Sikkim: Hooker 323 (K); Chumbi: Cooper 210 (E); Dungboo s.n. (K); Gould 840 (K); Hobson s.n. (K); King's collector 23 (E).
E. mairei: Bhutan: Gould 666 (K); Ludlow & Sherriff 3341 (BM); Ludlow, Sherriff & Hicks 17083 (BM, E); Sargent 82 (E); Sikkim: King's collector 23 (K).
E. royleana: Bhutan; Grierson & Long 112 (E); Miehe 00-147-06 (MB); Sikkim: King's collector s.n. (BM); Chumbi: Dungboo s.n. (K); King's collector 23 (K); Cooper 210 (E).
E. veratrifolia: Sikkim: King s.n. (E); Pantling 125 (BM, K, W).

Epipogium aphyllum: Bhutan: Ludlow, Sherriff & Hicks 16970 (BM); Miehe 00-286-07 (MB); 00-345-01 (MB); Wood 6668 (E); Sikkim: Pantling 418 (BM, K, W).
E. roseum: Darjeeling: Cave s.n. (E); Gamble 8224 (K); Sikkim: Anderson 1210 (W); Hooker 348 (K); s.n. (W); Kurz s.n. (BM); Pantling 147A (BM, K, W); 147B (K).

Eria acervata: Bhutan: Bowes Lyon 15119 (BM); Ludlow, Sherriff & Hicks 17026 (BM, E); Sikkim: Pantling 137 (K); 170A (E, K); 170B (BM, K); 170C (W); 170D (NBG).
E. alba: Bhutan: Bowes Lyon 10094 (E); Dorji, Pearce & Cribb 81 (E, K, THIM); Ludlow, Sherriff & Hicks 20549 (BM, E); Darjeeling: Treutler 186 (K); Sikkim: Hooker 68 (K-LINDL); s.n. (BM, OXF, W).
E. amica: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Hort. (K); Duars: Hooker 142 (K-LINDL); Sikkim: Clarke 27595 (K, W); Hooker s.n. (K); Lacaita 15526 (BM); Pantling 257A (BM, K, W); 257B (BM, E, K, W).
E. bambusifolia: Darjeeling: Pantling 355 (BM, K, W); Sikkim: Hooker s.n. (K).
E. biflora. Sikkim: Pantling 244 (BM, K, W).
E. bractescens: Sikkim: Pantling 137 (BM, K, W).
E. carinata: Bhutan: Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14836 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 14891 (TI); Sikkim: Pantling 1A (BM, K, W); 1B (NBG).
E. clausa: Bhutan. Hara Kanai, Murata, Ohahsi, Tanaka & Yamazaki 14750 (K, TI); Darjeeling: Pantling 359 (BM, K, W).
E. connata: Bhutan: Grierson & Long 4100 (E).
E. coronaria: Bhutan. Ludlow & Sherriff 2873 (E); Sinclair & Long 5661 (E); Darjeeling: Clarke 26413 (BM, W); Craib 630 (K); Gamble 261 (K); 267 (K); 28062 (BM); Griffith 5117 (E); Hara s.n. (TI); s.n. (TI); Togashi 1669 (TI); Sikkim: Clarke 9657 (W); 9724 (K); Hara s.n. (TI); Hooker s.n. (K, W); Hooker & Thomson 144 (K-LINDL, K); King s.n. (W); Pantling 27 (BM, K, W); Treutler 1005 (K).
E. discolor: Darjeeling: Clarke 27971 (K); Gamble 10334 (K); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Hooker 168 (K); Pantling 127A (BM, K, W); 127B (NBG); s.n. (BM).
E. excavata: Bhutan: Dorji, Pearce & Cribb 93 (E, K, THIM); Grierson & Long 3122 (E); Darjeeling: Gamble 9997 (K); Hara, Kanai, Murata, Togashi & Tuyama 1672 (TI); Murata & Togashi 1671 (TI); Pantling 273B (BM, W); Sikkim: Clarke 46457 (K); Hara s.n. (TI); Hara, Kanai, Murata, Togashi & Tuyama 1670 (TI); Pantling 273A (K).
E. ferruginea: Bhutan: Dorji, Pearce & Cribb 86 (E, K, THIM); Gurung 106 (Herb. D.B. Gurung); s.n. (E).
E. graminifolia: Darjeeling: Anderson 1238 (W); Gamble 904 (K); 10515 (K); Griffith 5115 (K); s.n. (K-LINDL, W); Pantling 371B (K, W); Sikkim: Hara s.n. (TI); Hooker s.n. (K); Long & Nolte 127 (E); Pantling 371A (BM, K); 371C (BM, K, W).

E. javanica: Sikkim: Pantling 91A (K, W); 91B (NBG).

E. lasiopetala: Bhutan: Grierson & Long 3618 (E, K, THIM); 3917 (E); Terai: Gamble 897 (K); Duars: Haines 611 (K); Darjeeling: Cave s.n. (E); Hara 1853 (TI), Togashi s.n. (TI); Sikkim: Gammie s.n. (K); Hooker 63 (K-LINDL); s.n. (K); King s.n. (BM); Pantling 130A (K); 130B (BM, K, W); Togashi s.n. (TI).

E. muscicola var. **muscicola**: Darjeeling: Clarke 9587 (BM); Sikkim: Pantling 163A (K); 163B (BM, E, K, W).

E. paniculata: Bhutan: Cooper 3765 (BM, E); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14542 (TI); 14612 (TI); 14699 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 14075 (TI); 14089 (TI); 14426 (TI); Ludlow, Sherriff & Hicks 18526 (BM); Sinclair & Long 5770 (E); Darjeeling: Elwes s.n. (K), Gamble 10337 (K); Sikkim: Clarke 27704 (BM, W); Hooker 67 (K-LINDL); s.n (BM, OXF, W); Pantling 103 (BM, K, W).

E. pannea: Bhutan: Cooper 3631 (E); Griffith 12 (K-LINDL); 1185 (K-LINDL); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1671 (TI); s.n. (TI); Hooker 62 (K-LINDL, K); Lacaita 16266 (BM); Pantling 144A (BM, K); 144B (W); Togashi s.n. (TI), Younghusband s.n. (K).

E. pumila: Bhutan: Grierson & Long 3798 (E); Sikkim: Pantling 291 (BM, K, W).

E. spicata: Bhutan: Cooper 2459 (E); 2861 (BM, E); 3428 (E); Grierson & Long 2960 (E); Gurung 62 (Herb. D.B Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 11221 (TI); Sinclair & Long 5766 (E); Darjeeling: Gamble 822A (K); 7017 (K); 10505B (K); Griffith 5113 (K); 5114 (K); s.n. (W); Treutler 550 (K); Sikkim: Clarke 12207 (BM), 12215 (W); 25247 (BM); Hara s.n. (TI); Hooker 60 (K-LINDL); s.n. (K); s.n. (W); Pantling 41A (BM, K); 41B (W); 41c (K); 41D (K); Togashi s.n. (TI).

E. stricta: Bhutan: Grierson & Long 3943 (E); Duars: Haines 2020 (K); Darjeeling: Gamble 555 (BM, K); Griffith 5118 (K); s.n. (K-LINDL); Hooker 59 (K-LINDL,K); Sikkim: Hara s.n. (TI); Hooker s.n. (BM, W); Pantling 65A (BM, K); 65B (E, W); Togashi s.n. (TI), Tuyama s.n. (TI).

E. vittata: Sikkim: Kirkpatrick 301 (E); Pantling 62A (BM, K, W); 62B (BM, K, W).

Eriodes barbata: Bhutan: Gurung 33 (E).

Erythrodes hirsuta: Bhutan: Pantling 255 (K).

Esmeralda cathcartii: Bhutan: Grierson & Long 4123 (E); Ludlow, Sherriff & Hicks 18505 (BM); Darjeeling: Cave s.n. (E); Gamble 4200 (K); 10352 (K); Griffith 5188 (K); 5259 (K); Sikkim: Hooker 175 (K-LINDL); s.n. (BM, K, OXF, W); Pantling 111A (BM, K, W); 111B (K).

E. clarkei: Darjeeling: Craib 620308 (K); Gamble 7582 (K); Sikkim: Clarke 25232 (K); 25384 (W); Pantling 20A (BM, K, W); 20B (BM, K, W).

Eulophia bicallosa: Terai: Gamble 6663 (K); Duars: Pantling 435 (BM, K); 436 (BM, W); Sikkim: Hooker 241 (K-LINDL, K).

E. dabia: Bhutan: Griffith 7 (K-LINDL); Hara, Kanai, Murata, Ohashi, Tanaka & Yamakazi 1838 (K); Ludlow, Sherriff & Hicks 20159 (BM), Wood 7534 (E); Terai: Pantling 431 (K); Duars: Gamble 6636 (K); 6673 (K); 7713 (K); Haines 2841 (K).

E. densiflora: Bhutan: Griffith 6 (K-LINDL); 5191 (K); Sikkim: Hooker 218 (K).

E. graminea: Bhutan: Ludlow, Sherriff & Hicks 20148 (K); 20157 (K); Tessier-Yandell 5 (K); Duars: Pantling 438C (BM, K, W); Sikkim: Pantling 438B (K, W).

E. mannii: Sikkim: Pantling 457 (BM).

E. promensis: Darjeeling: Pantling 282 (K).

E. spectabilis: Bhutan: Gould 302 (K); Ludlow, Sherriff & Hicks 20168 (BM); Terai: Hooker s.n. (K); Darjeeling: Clarke 35477 (K); Sikkim: Pantling 212 (BM, K).

E. stenopetala: Bhutan: Griffith 847 (K-LINDL); 5190 (K); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 12055 (TI).

E. zollingeri: Darjeeling: Clarke 11767 (K); Hooker 223 (K-LINDL); 361 (K-LINDL, K); Pantling 186A (K); 186B (BM, K).

Flickingeria fugax: Bhutan: Dorji, Pearce & Cribb 17 (E, K, THIM); Sargent 20 (E); Darjeeling: Gamble 7237 (K); 9649 (K); Sikkim: Pantling 266A (BM, W); 266B (BM, E, K).

Galeola cathcartii: *spec. n.v.*

G. falconeri: Bhutan: Greirson & Long s.n. (E); Ludlow, Sherriff & Hicks 20857 (BM, K); Darjeeling: Clarke s.n. (K); Lace s.n. (E); Sikkim: King 670 (BM); Kurz s.n. (BM); Pantling 87A (BM, K, W); 87B (K, W); Treutler s.n. (K); Thomson s.n. (K).

G. lindleyana: Bhutan: Bigger 2902 (E); Dorji, Pearce & Cribb 3 (E, THIM); Grierson & Long 2366 (E, K, THIM, TI); Gurung 58 (Herb. D.B. Gurung); Darjeeling: Clarke 9020 (K); 26818 (BM, W); 36329 (W); 36346 (BM); Gamble 780A (K); Sikkim: Hara, Kurosawa & Ohashi s.n. (TI); s.n. (TI); Hooker 356B (K-LINDL); 358 (K-LINDL); s.n. (BM, K, W); Kurzweil 168 (W); Pantling 88A (BM, K); 88B (W); Treutler 223 (K); Younghusband s.n.(K); s.n. (BM).

G. nudifolia: Sikkim: Pantling 321A (BM); 321B (W); 321C (K, W).

Gastrochilus acutifolius: Bhutan: Gurung 29 (Herb. D.B. Gurung); Darjeeling: Griffith 5248 (K); Sikkim: Hooker s.n. (K); Pantling 3A (W); 3B (BM, E, K, W).

G. affinis: Sikkim: Pantling 444 (BM, K).

G. calceolaris: Bhutan: Griffith 30 (K-LINDL, W); Gurung 101 (Herb. D.B. Gurung); Kanai, Murata, Ohashi, Tanaka & Yamazaki 11127 (TI); 11218 (TI); 11296 (TI); 11303 (TI); 11370 (TI); Ludlow & Sherriff 2923 (BM); Murata, Ohashi & Yamazaki 10092 (TI); Darjeeling: Clarke 12637 (W); Gamble 696 (K); Griffith 5207 (K); s.n. (W); Hara & Togashi 3287 (K, TI); 3288 (TI); Sikkim: Clarke 25150 (BM); 27573 (K); Hara s.n. (TI); Hara, Kanai, Murata, Togashi & Tuyama 3289 (K, TI); Hooker 187 (K-LINDL); s.n. (K, W); Pantling 68 (BM, E, K, W).

G. dasypogon: Darjeeling: Cowan s.n. (E, K); Sikkim/Bhutan: Trudel photo. (vide Seidenfaden, 1987).

G. distichus: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 20512 (E, BM); Darjeeling: Biswas s.n. (W); Cowan s.n. (E, K); Gamble 8066 (K); Gammie s.n. (K); Griffith 5211 (K); Hara & Togashi 1661 (TI); 1662 (TI); Kanai, Murata, Togashi & Tuyama 1663 (TI); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Hooker 206 (K-LINDL); s.n. (K); Pantling 132 (BM, K, W).

CHECKLIST OF SPECIMENS EXAMINED

G. inconspicuus: Bhutan: Grierson & Long 3642 (E); Darjeeling: Kurzweil 165 (K); 247 (KL); Sikkim: Pantling 159 (BM, W).
G. linearifolius: Sikkim: Pantling 356 (BM, K, W).
G. obliquus: Darjeeling: Clarke 12637 (K, W); Gamble 3987 (K); Kurzweil 159 (K); Sikkim: Clarke 13196 (K); Pantling 248A (K); 248B (BM, K, W).
G. pseudodistichus: Darjeeling: Cave s.n. (E); Clarke 26931 (K, W); Sikkim: Clarke 25239 (BM, K); 25396 (BM); King 3052 (AMES); Pantling 49A (W); 49B (AMES, BM, K, L).

Gastrodia dyeriana: Darjeeling: Ohashi & Hara 723595 (K, TI); Sikkim: Pantling 293 (BM, K, W).
G. elata: Bhutan: Cooper 2927 (E); Gurung 2 (Herb. D.B. Gurung); Sargent 208 (E); Sikkim: Younghusband s.n. (K); Chumbi: King's collecter s.n. (K).

Geodorum densiflorum: Terai: Clarke 12074 (BM); Darjeeling: Kurzweil 132 (NBG); 260 (K); Sikkim: Hooker s.n. (K); Pantling 279A (BM, K); 279B (NBG).

Goodyera alveolata: *spec. n.v.*
G. clavata: Sikkim: Pantling 460 (BM, K).
G. dongchenii: Sikkim: Lucksom 210 (CAL. *n.v.*).
G. foliosa: Bhutan: Ludlow & Sherriff 969 (BM, E); Darjeeling: Cave s.n. (E); Clarke 12548 (K); Cowan s.n. (E, K); Gamble 3981A (K); Pantling 5A (BM, K, W); 5B (BM, E, K, W); Treutler 857 (K); Sikkim: Hooker 331 (K-LINDL, K); King 3061 (BM).
G. fumata: Sikkim: Pantling 467 (K).
G. fusca: Bhutan: Cooper 2197 (E); Ludlow, Sherriff & Hicks 17193 (BM); 21157 (BM); Miehe 00-201-06 (MB); 00-268-02 (MB); 00-370-01 (MB); Sikkim: Hooker 347 (K-LINDL, K); s.n. (K); Macpherson 91 (E); Pantling 411 (K); Starling 578 (K).
G. hemsleyana: Bhutan: Grierson & Long 4642 (E); Darjeeling: Hara s.n. (K, TI); Pantling 215A (BM, K, W); 215B (L, NBG).
G. hispida: Darjeeling: Pantling 190A (BM, K, W); 190B (K); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1665 (TI).
G. procera: Bhutan: Gurung 86 (Herb. D.B. Gurung); Grierson & Long 3470 (E, THIM); Wood 7245 (E); Darjeeling: Cave s.n. (E); Gamble 689A (K); Hara & Togashi 1666 (TI); Murata & Togashi 1667 (K, TI); Sikkim: Clarke 27288 (K); 27297 (BM); Gamble 10308 (K); Hooker 291 (K); s.n. (BM, K, W); Kurzweil 192 (K); Ludlow, Sherriff & Taylor 4001 (BM, E); Pantling 67A (BM, W); 67B (K).
G. recurva: Bhutan: Gurung s.n. (Herb. D.B. Gurung).
G. repens: Bhutan: Bigger 2986 (E); Cooper 2130 (E); 3376 (E); Ludlow & Sherriff 971 (BM, E); Ludlow, Sherriff & Hicks 19654 (BM, E); 21047 (BM); Ludlow, Sherriff & Taylor 19654 (BM); Miehe 00-286-01 (MB); 00-434-03 (MB); Sargent 246 (E); Wood 5688 (E); 7177 (E); Sikkim: Clarke 25875 (K, W); Hooker 349 (K); s.n. (BM, K, OXF, W); Pantling 277 (BM, K); Younghusband s.n. (K); Chumbi: King's collector 155 (K).
G. schlechtendaliana: Bhutan: Grierson & Long 4603 (E); Griffith s.n. (K-LINDL); Hara s.n. (TI); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 2192 (TI); Hara & Kurosawa s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 8291 (TI); s.n. (TI); Kurosawa s.n. (TI); Sinclair & Long 4958 (E, K, THIM); Wood 6551 (E); 7578 (E); Darjeeling: Hara s.n. (TI); Kurosawa s.n. (K, TI); Pantling 292A (W); 292B (BM, K).
G. viridiflora: Bhutan: Cooper 2857 (E); Gurung 67 (Herb. D.B. Gurung); Murata, Ohashi & Yamazaki 9927 (TI).
G. vittata: Bhutan: Cooper 4389 (BM); Hara s.n. (TI); s.n. (TI); Ludlow & Sherriff 975 (BM); Ludlow, Sherriff & Hicks 21006 (BM, E); Sargent 34 (E); 231 (E); Sikkim: Hooker 336 (K-LINDL, K); s.n. (K); s.n. (K-LINDL); Long, McBeath, Noltie & Watson 764 (E); Pantling 95A (BM); 410A (E, K); 410B (BM, K, W); 410C (W).

Gymnadenia orchidis var. **orchidis**: Bhutan: Bedi 335 (THIM); 610 (K, THIM); 1244 (K, THIM); Bowes Lyon 15101 (BM); Cooper 2483 (BM, E, THIM); 3090 (E); Dorji & Nawang s.n. (THIM); Gould 902 (K); 1207 (K); Ludlow & Sherriff 3380 (BM); 16630 (BM); 19210 (BM); 20411 (BM); 20782 (BM); Miehe 00-147-07 (MB); 00-148-16 (MB); 00-151-23 (MB); 00-226-07 (MB); 00-332-14 (MB); Sinclair & Long 5288 (E); Darjeeling: Kanai, Ohashi, Hara, Iwatsuki & Ohba 726211 (TI); Wood 6473 (E); Sikkim: Cooper 616 (E); Dungboo s.n. (K); Hooker 292 (K-LINDL, K); s.n. (K); King's collector s.n. (K); s.n. (BM); Long, McBeath, Noltie & Watson 302 (E); Pantling 404A (BM, K); Renz 10085 (BAS); Ribu & Rohmoo 6491 (E); Starling, Cunnington, Main, Haselgrove, Macpherson & Mason (AGSES) 657 (K); Younghusband s.n. (K); Chumbi: Dungboo s.n. (K); s.n. (K); King's collector 469 (K); Lowndes 757 (E); Spencer Chapman 819 (K); 842 (K).
G. orchidis var. **pantlingii**: Bhutan: Bedi 394 (K, THIM); Grierson & Long 2775 (E); Sikkim: Lowndes 606 (E); Pantling 404B (BM, K); Rohmoo 842 (E); Starling, Upward, Brickell & Mathew (AGSES) 287 (K).

Habenaria aitchisonii: Bhutan: Miehe 00-255-02 (MB); 00-284-02 (MB); Sargent 114 (E); Sikkim: Hooker 303 (K-LINDL, K); s.n. (K); Chumbi. Rohmoo 105 (E, K).
H. arietina: Bhutan: Cooper 3303 (BM, E); 4224 (BM, E); Ludlow & Sherriff 312 (BM); Ludlow, Sherriff & Hicks 17079 (BM, E); 20892 (BM, E); 20942 (BM, E); Noltie 30 (E); Wood 7049 (E); 7391 (E); Darjeeling: Clarke 26860 (BM); Cowan s.n. (E, K); Gamble 3996 (K); 9629 (K); s.n. (K); Haines 694 (K); Hara, Kurosawa & Ohashi s.n. (TI); s.n. (TI); s.n. (TI); s.n. (TI); s.n. (TI); Kanai, Ohashi, Hara, Iwatsuki & Ohba 726145 (TI); 726146 (TI); 726147 (TI); 726148 (TI); Ohashi, Hara & Iwatsuki 726144 (TI); Treutler 549 (K); Sikkim: Cave 121 (E, K); Gamble 7021 (K); Gammie 267 (BM); Hooker s.n. (K); Long, McBeath, Noltie & Watson 836 (E); Pantling 333A (BM, E); 333B (K); 333C (BM, K).
H. dentata: Bhutan: Broad 233 (E); Darjeeling: Clarke 9145 (E, K, W); 9359 (K); 12615 (BM); 24918 (E); 24923 (E); 25077 (E, K); Gamble 3994 (K); 9886 (K); Sikkim: King s.n. (W); King's collector s.n. (BM); Pantling 97A (BM, K, W); 97B (E, NBG).
H. diphylla var. **josephi**: Bhutan: Cooper 1608 (BM, E); Gould 1083 (K); Ludlow, Sherriff & Hicks 16725 (BM, E); 19397 (BM, E); 20444 (BM, E); Miehe 00-239-13 (MB), 00-257-09 (MB); 00-283-06 (MB); Rohmoo 450 (E); Sargent 113 (E); Sinclair & Long 5289 (E, THIM); Sikkim: Hooker 253 (K-LINDL); s.n. (K); Long & Noltie 305 (E); Pantling 398 (BM, K, W); Chumbi: Dungboo s.n. (K); King's collector 22 (K).
H. furcifera: Darjeeling: Gamble 4020 (K); Pantling 335A (W); 335B (BM, K); 335C (NBG); Sikkim: Gamble 10488 (BM, K); King's collector s.n. (K).
H. malleifera: Darjeeling: Cowan s.n. (E).
H. marginata: Bhutan: Ludlow & Sherriff 940 (BM); Ludlow, Sherriff & Hicks 21026 (BM, E).

H. pantlingiana: Darjeeling: Gamble 898 (K); Sikkim: Hooker 258 (K-LINDL); s.n. (K); Pantling 415 (BM, K, W).
H. pectinata: Sikkim: Hooker s.n. (E, K); Pantling 177A (BM); 177B (K); 177C (E, K, W); 177D (BM).
H. plantaginea: Terai: Hooker s.n. (K).
H. reflexa: Darjeeling: Pantling 182A (K); 182B (BM); 182C (W).
H. stenopetala: Bhutan: Broad 334 (E); Wood 7050 (E); Darjeeling: Clarke 12612 (BM, K); 36190 (BM), Gamble 7284 (K), 9992 (K). Gammie s.n. (K); Pantling 57B (BM, K); Sikkim: Anderson 1250 (W); Hooker s.n. (K); Kurz s.n. (BM); Pantling 57A (W); 57C (NBG)
H. trichosantha: Bhutan: Bowes Lyon 15159 (BM); Cooper 4197 (E); Ludlow, Sherriff & Hicks 20990 (BM, K).

Hemipilia cordifolia: Bhutan: Bigger 2954 (E); Nishioka s.n. (K); Wood 5657 (E).

Herminium angustilabre: Sikkim. Pantling 375A (W); 375B (BM, E, K, L); 375C (BM, K, W)
H. duthiei: Bhutan: Gould 556 (K); 735 (K); 1068 (K); Miehe 00-124-05 (MB); 00-151-10 (MB); 00-254-05 (MB); 00-298-06 (MB).
H. jaffreyanum: Sikkim: Gamble 3967 (K), Hooker 279 p.p. (K-LINDL); Pantling 237A (K, L, W); 237B (E, K, W)
H. josephi: Bhutan: Bedi 618 (K); Bigger 2875 (E); Bowes Lyon 3366 (BM); Cooper 1609 (BM, E); Ludlow & Sherriff 19161 (BM), Ludlow, Sherriff & Hicks 16437 (BM, E); 19191 (BM); 20436 (BM, E); Miehe 00-161-10 (MB); 00-165-08 (MB); 00-190-30 (MB); 00-239-10 (MB); 00-253-03 (MB); 00-254-03 (MB); 00-257-08 (MB); 00-257-43 (MB); 00-272-07 (MB); 00-273-56 (MB), 00-274-16 (MB); 00-283-18 (MB); 00-289-16 (MB); 00-349-08 (MB); 00-349-38 (MB); Sargent 32 (E); 112 (E); 116 (E); Sinclair & Long 5169 (E), Wood 5535 (E); 6485 (E); 6489 (E); Sikkim: Hooker 264 (K-LINDL, W); s.n. (K); s.n. (BM, OXF); Long, McBeath, Noltie & Watson 602 (E), Long & Noltie 307 (E); 321 (E); Pantling 381A (BM, E, K, W); 381B (BM, K, W); Starling, Upward, Brickell & Mathew 138 (E, K); Chumbi: Bor & Ram 19707 (K); Dungboo s.n. (K); King's collector (K); 20324 (K); Lowndes 757 (E); Spencer Chapman 472 (K); 823 (K); 834 (K).
H. kalimpongense: Darjeeling: *Pradhan's collectors* (Herb. Pradhan, *n.v.*).
H. lanceum var. lanceum: Bhutan: Gurung 3 (Herb. D.B. Gurung); 65 (Herb. D.B. Gurung); Grierson & Long 2849 (E); Griffith s.n. (K); Miehe 00-283-04 (MB); Sinclair & Long 4785 (E); Wood 5660 (E); 5694 (E, THIM); Darjeeling: Cave s.n. (E); Clarke 8534 (K); 9342 (E); 26846 (K, W); 26970 (BM, E); 27012 (E); 35901 (K); Cowan s.n. (E, K); Drummond 21032 (K); Gamble 167 (BM); 3969 (K); 4009 (K); Hara s.n. (TI); Kanai, Ohashi, Hara, Iwatsuki & Ohba 726129 (TI); 726130 (TI); 726131 (TI); 726132 (TI); Long, McBeath, Noltie & Watson 1080 (E); Pantling 44A (K, W); Treutler 454 (K); Sikkim: Cave s.n. (E); Clarke 9777 (K, W); Gamble 7078 (K); Hooker 200 (K-LINDL); s.n. (BM, K, OXF, W); Long, McBeath, Noltie & Watson 979 (E); Long & Noltie 110 (E); Pantling 44B (BM, E); 44C (K); 44D (BM, K, W); Townend 152 (OXF).
H. mackinnonii: Sikkim: Hooker 279 p.p. (K-LINDL); s.n. (K).
H. macrophyllum: Bhutan: Bedi 349 (K); Bowes Lyon 15031 (BM); Ludlow, Sherriff & Hicks 20309 (BM); Miehe 00-165-19 (MB); 00-165-39 (MB); 00-165-40 (MB); 00-286-08 (MB); Nishioka s.n. (TI); Sargent 31 (E); Wood 5570 (E); 6463 (E); Darjeeling: Kanai, Ohashi, Hara, Iwatsuki & Ohba 721376 (TI); 726135 (TI); Tokyo University s.n. (TI); s.n. (TI); Sikkim: Cooper 55 p.p.(E); Hooker 265 (K-LINDL); s.n. (W); Long & Noltie 49 (E); Lowndes 608 (E); 741 (E); Pantling 384A (BM, W); 384B (BM, W); 384C (BM, W); 384D (BM, E, W); Renz 10086 (BAS); Ribu & Rohmoo 6362 (E); Rohmoo 244 (E); 819 (E); Chumbi: Rohmoo 73 (E); Spencer Chapman 455 (K); 818 (K).
H. monophyllum: Sikkim: Cooper 55 p.p. (E).
H. monorchis: Sikkim: Hooker 263 (K-LINDL); Chumbi: Spencer Chapman 799 (K).
H. orbiculare: Bhutan: Wood 7104 (E); Darjeeling: Pantling 456 (K); Sikkim: Pantling 384A (BM, E, K, W); 348C (BM, K, W); Chumbi: King's collector 164 (K); Pantling 384B (BM, K, W).
H. pygmaeum: Bhutan: Noltie 105 (E).
H. quinquelobum: Sikkim: Pantling 339 (K); Renz 10094 (BAS); 10095 (BAS).

Herpysma longicaulis: Bhutan: Gurung 87 (Herb. D.B. Gurung); Darjeeling: Clarke 13581 (K); 13803 (W); Sikkim: Hooker 340 (K-LINDL); Pantling 240 (BM, K, W); Treutler 1173 (K).

Hetaeria affinis: Bhutan: Cooper 4388 (BM); Darjeeling: Clarke 27288 (W); Sikkim: Hooker s.n. (K); Pantling 202 (BM, K, W).
H. pelota: Bhutan: Cooper 2714 (BM, E).

Ione andersonii: Darjeeling: Anderson s.n. (CAL *n.v.*).
I. bicolor: Bhutan: Bowes Lyon 13017 (E); Grierson & Long 3239 (E); 4076 (E); Darjeeling: Clarke 26415 (K, W); Gamble 276A (BM, K); 7577 (K); 10007 (K); 10307 (BM, K); Griffith 5138 (K); s.n. (K-LINDL); Hara & Togashi 1656 (K, TI); Pantling 247A (K, W); 247B (BM); Sikkim: Clarke 13600 (K, W); Hara, Kanai, Murata, Togashi & Tuyama 1655 (TI); Hooker 69 (K-LINDL); s.n. (BM, K, L, OXF, W); Pantling 247C (NBG); Treutler 979 (K).
I. candida: Bhutan: Balakrishnan 41999 (CAL *n.v.*).
I. cirrhata: Bhutan: Gurung 31 (Herb. D.B. Gurung); Darjeeling: Clarke 26414 (K, W); Craib 313 (K); Gamble 276B (K); 9995 (K); Griffith 5176 (K); s.n. (K-LINDL); Togashi 1657 (K, TI); Sikkim: Gamble 9435 (K); Hooker 51 (K-LINDL); King 3068 (W); s.n. (BM); Pantling 100A (K, W); 100B (BM, K); 100C (NBG).

Lecanorchis sikkimensis: Bhutan: Dorji, Pearce & Cribb 77 (E, K, THIM); Sikkim: Prain's collector s.n. (K).

Liparis bistriata: Sikkim: Gamble 9685 (K); Gammie 284 (BM); Hooker s.n. (K); Pantling 289A (BM, K, W); 289B (BM, E, K); 289C (E, NBG).
L. bootanensis: Bhutan: Cooper 2826 (E); 3362 (E); Griffith 1460 (K-LINDL); Gurung s.n. (Herb. D.B. Gurung); Darjeeling: Gamble 10505A (K); s.n. (K); Sikkim: Gammie s.n. (K); Kurzweil 261 (KL); Pantling 343 (BM, K, W); Younghusband s.n. (K).
L. caespitosa: Bhutan: Grierson & Long 3606 (E); Darjeeling: Cave s.n. (E); Gamble 8260 (K); 9686 (K); 10493 (K); Kanai, Ohashi, Hara, Iwatsuki & Ohba 721583 (TI); Sikkim: Clarke 12327 (K); Hara, Kurosawa & Ohashi s.n. (TI); Kurzweil 177 (NBG); Long, McBeath, Noltie & Watson 784 (E); Pantling 85 (BM, K, W); 179A (BM, K); 179B (NBG); Ribu & Rohmoo 5625 (K).
L. cathcartii: Bhutan: Ludlow, Sherriff & Hicks 18791 (BM, E); 20515 (BM); Miehe 00-254-07 (MB); Darjeeling: Clarke 35033 (BM, K,

W); 35037 (K, W); Sikkim: Hooker 103 (K-LINDL, K); Pantling 369A (BM, K, W); 369B (BM, K, W); 369C (BM, E, K, W); Chumbi: King's collector 600 (K).
L. cordifolia: Sikkim: Clarke 25184 (K); Pantling 134A (BM, K); 134B (W).
L. deflexa: Darjeeling: Griffith 5367 (K, K-LINDL); Kurzweil 146 (NBG); Sikkim: Pantling 336 (BM, E, K, W).
L. delicatula: Darjeeling: Cowan s.n. (E); Pantling 155A (K); 155B (W).
L. elliptica: Sikkim: Clarke 9721 (K, W).
L. gamblei: Darjeeling: Clarke 12235 (K); Gamble 3988A (K); 10503 (K); Pantling 150 (BM, K, W); Sikkim: Clarke 12450 (K).
L. glossula: Sikkim: King's collector s.n. (BM, K); Chumbi: Dungboo s.n. (K); Hobson s.n. (K); Pantling 402 (K, W).
L. lydiae: Sikkim: S.Z Lucksom 198 (CAL).
L. mannii: Duars: Pantling 466A (BM, K, W); 466B (NBG).
L. nervosa var. **khasiana**: Darjeeling: Das 603 (CAL n.v.).
L. nervosa var. **nervosa**: Darjeeling: Griffith 5743 (K); Sikkim: Hooker 97 (K-LINDL); 165 (K); s.n. (K); Pantling 222A (K); 222B (W); 222C (K).
L. odorata: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Noltie 31 (E); Sikkim: Pantling 228A (BM, K, W); 228B (K); 228C (BM, E, K, W); 228D (BM, K, W); 228E (NBG).
L. perpusilla: Bhutan: Grierson & Long 3077 (E); Miehe 00-116-13 (MB); Darjeeling: Clarke 26872 (K, W); Gamble 9421 (K); Hooker 110 (K-LINDL, K); Sikkim: Hara, Kurosawa & Ohashi s.n. (TI); Hooker s.n. (K); Pantling 380A (K, W); 380B (E, K, W).
L. petiolata: Bhutan: Ludlow & Sherriff 321 (BM); Darjeeling: Cowan s.n. (E, K); Griffith 5067 (K); 5368 (K); 5369 (K); Sikkim: Hara, Kurosawa, Ohashi s.n. (TI); Hooker 106 (K, K-LINDL); Pantling 217A (BM, W); 217B (BM, K, W).
L. plantaginea: Bhutan: Griffith 5069 (K); Darjeeling: Clarke 9083 (K); 13695 (K); Sikkim: Gamble 9547 (K); Pantling 153A (BM, K); 153B (K, W).
L. platyrhachis: Sikkim: Clarke 25109 (K); 25141 (K); 25153 (K); Pantling 417 (K, W); Treutler 967 (K).
L. pygmaea: Sikkim: Long, McBeath, Noltie & Watson 207 (E); Pantling 449A (E, K, W); 449B (L, W); Bor & Ram 19902 (K).
L. resupinata: Bhutan: Grierson & Long 3081 (E, K, THIM); Gurung 39 (Herb. D.B. Gurung); Darjeeling: Clarke 26387 (W); 27088 (K); 27235 (K); Craib 638-314 (K); Gamble 7625 (K); Griffith 5080 (K); 5081 (K); s.n. (K-LINDL); Sikkim: Hara s.n. (TI); Hara, Kanai, Murata, Togashi & Tuyama 1658 (TI); Hooker 89 (K); 90 (K-LINDL); s.n. (K, W); Pantling 60 (K, W); 201 (E, K, W); Treutler 966 (K).
L. somai: Sikkim: Lucksom & Kumar 197 (holo. CAL, n.v.).
L. stricklandiana: Bhutan: Griffith 5069 (K); Sikkim: Pantling 465 (BM, K).
L. tigerhillensis: Darjeeling: Das 1051 (CAL, n.v.).
L. viridiflora: Bhutan: Dorji, Pearce & Cribb 57 (E, K, THIM); Griffith 5076 (K); 5077 (K); Gurung s.n. (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14630 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 14297 (TI); Ludlow, Sherriff & Taylor 6793 (BM, E); Darjeeling: Clarke 13245 (BM, K); Cowan s.n. (E, K); Gamble 7623 (K); Hooker & Thomson s.n. (K); Sikkim: Hooker 108 (K-LINDL); s.n. (BM, K); s.n. (W); Pantling 59A (K, W); 59B (BM); 59C (BM, K); 198 (K, W).

Listera alternifolia: Sikkim: Pantling 390A (AMES, E, K, W); 390B (BM, K, L, W).
L. brevicaulis: Bhutan: Gurung s.n. (E); Sikkim: Pantling 392 (AMES, BM, K, L, W).
L. dentata: Sikkim: Pantling 452 (BM, K, W).
L. longicaulis: Bhutan: Wood 5653 (E); Sikkim: Pantling 391A (BM, L, W); 391B (AMES); 391C (E, K).
L. micrantha: Bhutan: Ludlow, Sherriff & Hicks 21055 (BM, E); Sikkim: Hooker 353 (K); Pantling 377A (BM, K, W); 377B (BM, K, W); 377C (BM, E).
L. mucronata: Bhutan: Ludlow & Sherriff 3158 (BM).
L. ovata: spec. n.v
L. pinetorum: Bhutan: Bowes Lyon 15082 (BM); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 21704 (TI); Ludlow, Sherriff & Hicks 16926 (BM, K); 19316 (BM, K); Miehe 00-286-04 (MB); Wood 6992 (E); Darjeeling: Kanai, Ohashi, Hara, Iwatsuki & Ohba 726103 (TI); Sikkim: Cooper 159 (BM, E); Hooker 355 (K); s.n. (AMES, K, W); Pantling 376A (BM, E, K, W); 376B (BM, K, W); Starling, Upward, Brickell & Mathew 300 (K); Chumbi: Hobson s.n. (K); King's collector s.n. (K, W).
L. tenuis: Sikkim: Cummins s.n. (K); Hooker 354 (K); s.n. (K); Pantling 378A (BM, E); 378B (K, W).

Luisia brachystachys: Bhutan: Murata, Ohashi & Yamazaki 10089 (TI); Duars: Anderson 470 (BM, K).
L. filiformis: Bhutan: Gurung 95 (Herb. D.B. Gurung); 96 (Herb. D.B. Gurung); Sikkim: Pantling 122A (BM, K, W); 122B (BM, E, K).
L. trichorrhiza: Bhutan: Cooper 1207 (E); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1654 (K, TI); Togashi s.n. (TI); Darjeeling: Gamble 7015 (K); Sikkim: Hooker s.n. (K, W); Pantling 205A (BM); 205B (K, W).
L. zeylanica: Bhutan: Dorji, Pearce & Cribb 10 (E, K, THIM); Grierson & Long 3594 (E); Kanai, Murata, Ohashi, Tanaka & Yamazaki 10331 (TI); 14887 (TI); 14976 (TI); Darjeeling: Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1653 (TI); Pantling 115A (BM, K); 115B (BM, K, W); 115C (W).

Malaxis acuminata: Bhutan: Bowes Lyon 13018 (E); Cooper 1182 (BM, E); Dorji, Pearce & Cribb 99 (THIM); Noltie 51 (E); Darjeeling: Clarke 8533 (K); 26749 (K); 35370 (BM); Cowan s.n. (E, K); Hara 1650 (TI); Hara, Kanai, Murata, Togashi & Tuyama 1649 (TI); Kanai, Murata & Togashi 1651 (TI); 1652 (TI); Kurzweil 128 (KL); 141 (W); 207 (KL); Long, McBeath, Noltie & Watson (ESIK) 93 (E); 1213 (E); Gamble 719 (K); 8281 (K); Pantling 448A (BM, E, K); Treutler 584 (K); Sikkim: Long, McBeath, Noltie & Watson (ESIK) 898 (E); Pantling 37A (BM); 37B (K); 448B (NBG).
M. aphylla: Sikkim: Pantling 455 (K, W).
M. calophylla: Sikkim: Pantling 220A (W); 220B (BM, K).
M. cylindrostachya: Bhutan: Bigger 2942 (E); Gould 1029 (K); King's collector s.n. (K); Miehe 00-298-02 (MB); Wood 6486 (E); Sikkim: Hooker s.n. (K); s.n. (W); Pantling 358 (BM, E, K); 379 (BM, K, W); Chumbi: Dungboo s.n. (K); Hobson s.n. (K); Spencer Chapman 341 (K); 371 (K).
M. josephiana: Darjeeling: Clarke 35077 (K); 35483 (BM, K, W); Sikkim: Pantling 312A (W); 312B (BM, K).
M. khasiana: Darjeeling: Cave s.n. (E); Sikkim: Pantling 283 (BM, K, W).
M. maximowicziana : Darjeeling: Pantling 226 (K).

M. muscifera: Bhutan: Bowes Lyon 15069 (BM); Cooper 1610 (BM, E); Grierson & Long 2816 (E, K, THIM, TI); Gurung 18 (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 21706 (TI); Ludlow, Sherriff & Hicks 16665 (BM); 19317 (BM); 20446 (BM, E); Miehe 00-149-03 (MB); 00-160-32 (MB); 00-254-08 (MB); 00-286-02 (MB); 00-298-01 (MB); Nolte 6 (E); Sargent 91 (E); Wood 6455 (E); 6472 (E); Darjeeling: Clarke 27535 (BM); Gamble 9482 (K); Hara s.n. (K, TI); Kurzweil 202 (K); Long, McBeath, Nolte & Watson (ESIK) 48 (E); Sikkim: Clarke 12547 (K); Gammie s.n. (BM); Hooker 101 (K-LINDL, K); s.n. (BM, W); King's collector s.n. (K); Pantling 395A (E, K); 395B (BM, K, W); 395C (BM, K, W); Younghusband s.n. (K); Chumbi: Bor & Ram 20322 (K); Gould 1458 (K).
M. ophrydis: Bhutan: Grierson & Long 1500 (E); Gurung s.n. (Herb. D.B. Gurung); Sargent 227 (E); Darjeeling: Clarke 36589A (K); Kurzweil 142 (NBG), 143 (K); Sikkim: Hara, Kurosawa & Ohashi s.n. (TI); Hooker 99 (K-LINDL); s.n. (K); Pantling 89A (K); 89B (BM); 89C (BM, K, W).
M. saprophyta: Sikkim: Pantling 394 (K, W).

Micropera mannii: Bhutan: Grierson & Long 2437 (E, K, THIM); Gurung s.n. (Herb. D.B. Gurung); Sikkim: Pantling 173A (K); 173B (BM, K, W); 173C (K).
M. obtusa: Bhutan: Grierson & Long 3524 (E); Sikkim: Pantling 48A (K); 48B (K); 48C (W).

Mischobulbum megalanthum: Sikkim: Pantling 206A (W); 206B (K).

Monomeria barbata: Sikkim: Pantling 124A (K, W); 124B (BM).

Myrmechis pumila: Bhutan: Gurung 18 (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 19534 (BM); Ludlow & Sherriff 322 (BM); Darjeeling: Pantling 338 (BM, K); Sikkim: Hooker 325A (K-LINDL); s.n. (K); Pantling 162A (BM, K); 162B (BM, K, W); 162C (E, W); 162D (BM, K, W); Treutler 474 (K).

Neogyna gardneriana: Bhutan: Bedi 1123 (K); Cooper 3448 (BM); Gurung 37 (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 11214 (TI); Ludlow & Sherriff 1101 (BM).

Neottia acuminata: Bhutan: Miehe 00-276-02 (MB); Sikkim: Long, McBeath, Nolte & Watson 173 (E); Lowndes s.n. (E); Pantling 383A (AMES, BM, E, K, W); 383B (AMES, BM, K, W).
N. listeroides: Bhutan: Dungboo 240 (BM); Ludlow, Sherriff & Hicks 16664 (BM); Miehe 00-286-06 (MB); 00-344-01 (MB); Nolte 4 (E); Wood 5652 (E); Sikkim: Cooper 435 (E); Hooker 356A (K); Pantling 393 (AMES, BM, K, L, W); Chumbi: King's collector 31 (K).
N. pantlingii: Bhutan: Gould 1060 (K); Gurung s.n. (E); Sikkim: Smith & Cave 1020 (K); 2657 (drawing K).

Neottianthe cucullata var. cucullata: Bhutan: Wood 5685 (E).
N. cucullata var. calcicola: Bhutan: Bedi 1257 (K, THIM); Ludlow, Sherriff & Hicks 21435 (E); Miehe 00-268-01 (MB); 00-273-13 (MB); 00-289-07 (MB); 00-300-34 (MB); Wood 5708 (E); Sikkim: Hooker s.n. (K); Starling, Cunnington, Main, Haselgrove, Macpherson & Mason (AGSES) 613 (K); Chumbi: Lepcha collector 127 (E, K); Nishioka 37 (K); Spencer Chapman 471 (K); 813 (K).
N. secundiflora: Bhutan: Miehe 00-298-04 (MB); Sikkim: Cave 109 (E, K); Hooker 278 (K-LINDL); Pantling 419 (AMES, BM, K); Younghusband s.n. (K); Chumbi: Dungboo s.n. (K); Gould 1441 (K); Hobson s.n. (K); Spencer Chapman 374 (K); 302 (K).

Nephelaphyllum cordifolium: Darjeeling: Pantling 275 (K).
N. pulchrum var. sikkimensis: Bhutan: Griffith 5370 (K); Darjeeling: Pantling 216 (P).

Nervilia aragoana: Bhutan: Gurung 100 (Herb. D.B. Gurung); Sikkim: Pantling 143 (BM, CAL, K).
N. crociformis: Sikkim: Pantling 372 (BM, K, W).
N. falcata: Duars: Pantling 439 (CAL).
N. gammieana: Darjeeling: Clarke 27226 (K); 35473 (K); Gamble 508 (K); Gammie s.n. (K); Sikkim: Hooker s.n. (K); King s.n. (BM); Pantling 310 (BM, K, W).
N. hookeriana: Sikkim: King 2153 (CAL).
N. infundibulifolia: Bhutan: Gurung 59 (E, Herb. D.B. Gurung).
N. macroglossa: Bhutan: Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 13890 (TI); 14524 (TI); 14598 (TI); 14622 (TI); Sikkim: Clarke 27725 (K); Hara, Kanai, Murata, Togashi & Tuyama 1647 (K, TI); Hooker s.n. (K); Pantling 261 (BM, K, W).
N. plicata: Bhutan: Gurung 65 (Herb. D.B. Gurung); Sikkim: Pantling 140 (CAL n.v.).

Oberonia acaulis: Bhutan: Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14010 (TI); 14014 (TI); Darjeeling: Gamble 2050A/B (K); 10000 (K); 10579 (BM); Sikkim: Clarke 25123 (BM, K, W); Hara, Kanai, Murata, Togashi & Tuyama 1648 (K, TI); Hooker 114 (K-LINDL); 117 (K); s.n. (BM, K, W); Pantling 195A (K); 195B (BM, K); 195C (E, W).
O. angustifolia: Darjeeling: Griffith s.n. (K-LINDL).
O. brachystachys: Terai: Hooker 121 (K-LINDL); Sikkim: Hooker s.n. (K); Pantling 238A (BM, K, W); 238B (BM, E, K, NBG, W).
O. caulescens: Bhutan: Grierson & Long 3080 (E); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14626 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 2612 (TI); 4140 (TI); 5367 (TI); Darjeeling: Gamble 3999A/B (K); Hara & Togashi s.n. (TI); Pantling 166 (CAL); Sikkim: Pantling 227 (BM, K, W); 454B (E, W).
O. emarginata: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Sikkim: Pantling 324 (K); 423 (BM, CAL, K, L, W).
O. ensiformis: Duars: Pantling 305 (BM, K, W); Darjeeling: Griffith 5085 (K).
O. falcata: Darjeeling: Gamble 9883 (K); Sikkim: Clarke 9720 (K, W); 27466A (K); Cowan s.n. (E, K); Pantling 218A (BM, K); 218B (K); 218C (BM); 218D (BM, K, L, W); 454A (BM, K).
O. falconeri: Sikkim: Henderson s.n. (K).
O. jenkinsiana: Sikkim: Pantling 185A (BM, K); 185B (BM, W).
O. lobulata: Sikkim: Pantling 199 (CAL).
O. mucronata: Bhutan: Grierson & Long 3867 (E); Darjeeling: Clarke s.n. (W); Griffith s.n. (K-LINDL); Sikkim: Pantling 13A (BM, K, W); 13B (W).

O. obcordata: Darjeeling: Clarke 27466B (W); Gamble 7615 (K); Griffith 5087 (K); s.n. (K-LINDL); Sikkim: Clarke 10030 (K, W); Hooker s.n. (K); Hooker & Thomson 112 (K-LINDL); King 3053 (BM); Pantling 47A (BM, W); 47B (K); Treutler 1151 (K).
O. pachyphylla: spec. n.v.
O. pachyrachis: Darjeeling: Gamble 554 (K); Sikkim: Hooker s.n. (K); Gamble 4000A (K); Pantling 105A (BM, E, W); 105B (BM, K, W).
O. prainiana: Darjeeling: Pantling 225 (CAL).
O. pyrulifera: Sikkim: Pantling 191A (BM, K); 191B (BM, W).
O. recurva: Sikkim: Henderson s.n. (K); Pantling 203 (BM, K, W); 254A (BM, CAL, K, W); 254B (L).
O. rufilabris: Duars: Haines 596 (K); 2836 (K); Pantling 430 (BM, K, W).

Odontochilus clarkei: Darjeeling: Clarke 26741 (K).
O. crispus: Bhutan: Grierson & Long 3375 (E); Ludlow & Sherriff 989 (BM); Darjeeling: Clarke 27345 (K); Sikkim: Clarke s.n. (K); Pantling 294A (K); 294B (BM, W).
O. elwesii: Bhutan: Ludlow & Sherriff 339 (BM); Wood 7040 (E); Darjeeling: Clarke 12251 (K); Gamble10548 (K); Sikkim: Pantling 224 (BM, E, K, W).
O. grandiflorus: Sikkim: S. Kurz s.n. (BM); Hooker 329 (K) s.n. (AMES, K); Pantling 325 (BM, K, W).
O. lanceolatus: Bhutan: Bowes Lyon 196 (BM); Cooper 3280 (E); 3297 (BM, E); 3447 (E); Wood 6628 (E); Darjeeling: Clarke 8620 (K); 12399 (K); 12522 (K); Gamble 28060 (K); Griffith 5345 (K); 5353 (K); King 4060 (BM); Sikkim: Clarke 12404 (K); 13139 (K); Hooker 338 (K) 341 (K); Pantling 196A (E); 196B (BM, W); 461 (BM, K, W).
O. tortus: Bhutan: Cooper 2714 (E); Duars: Pantling 354 (BM, K).

Oreorchis foliosa var. **foliosa**: Bhutan: Miehe 00-148-15 (MB); Sikkim: Hooker 213A (K-LINDL).
O. foliosa var. **indica**: Bhutan: Bedi 805 (K); Bowes Lyon 15984 (BM); Dungboo 274 (K); Grierson & Long 324 (E); Kanai, Murata, Ohashi, Tanaka & Yamazaki 5662 (TI); 12456 (TI); Ludlow & Sherriff 234 (BM); Ludlow, Sherriff & Hicks 16553 (BM, E); Sikkim: Hooker 213B (K-LINDL); Pantling 399A (BM, K, P, W); Chumbi: Hobson s.n. (K).
O. micrantha: Bhutan: Bowes Lyon 15071 (BM); Cooper 1352 (E); Grierson & Long 237 (E, THIM); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki s.n. (TI); Ludlow & Sherriff 3332 (BM); Ludlow, Sherriff & Hicks 16509 (BM); Wood 6396 (E); Darjeeling: Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Long, McBeath, Noltie & Watson 49 (E); Sikkim: Hara, Kurosawa & Ohashi s.n. (TI); Pantling 399B (K, W); 400 (BM, K, P).
O. sanguinea: Bhutan: Wood 6403 (E).

Ornithochilus difformis: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Darjeeling: Cowan s.n. (E); Griffith 5225 (K); Darjeeling/Sikkim: Gamble 10451 (K); Sikkim: Biermann s.n. (BM); Hooker 204 (K-LINDL); s.n. (AMES, K); Long, McBeath, Noltie & Watson 869 (E); Pantling 38A (BM, K, W); 38B (NBG).

Otochilus albus: Darjeeling: Clarke 12039 (W); 35418 (BM, W); Treutler 204 (K); Sikkim: T. Anderson 1223 (W); Cave s.n. (E); Hooker 81 (K-LINDL, K); s.n. (AMES, W); Pantling 35A (K); 35B (BM, K, W); 200B (NBG).
O. fuscus: Bhutan: Cooper 1179 (BM); 3675 (BM, E); Gould 661 (K); Grierson & Long 2961 (E, K, THIM, TI); Griffith 10 (K-LINDL); Gurung 34 (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14687 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 11118 (TI); 11217 (TI); 14653 (TI); Sinclair & Long 5768 (E); Darjeeling: Gamble 7518 (K); Griffith 5041 (E, K); 5053 (K); s.n. (W); Sikkim: Gammie s.n. (K); Hooker s.n. (AMES, BM, E, K, OXF, W); Hooker & Thomson 82 (K-LINDL); D. Lang s.n. (E); Pantling 61A (BM, E, K, W); 61B (BM, K).
O. lancilabius: Bhutan: Bowes Lyon 13014 (E); Cooper 3681 (BM, E); Gould 772 (K); Grierson & Long 3032 (E); Gurung 35 (Herb. D.B. Gurung); 82 (Herb D.B. Gurung); Kanai, Murata, Ohashi, Tanaka & Yamazaki 1110 (TI); 5868 (TI); 11215 (TI); 11303 (TI); 14291 (TI); 14293 (TI); 14978 (TI); Ludlow & Sherriff 2872 (BM); Ludlow, Sherriff & Taylor 7221 (BM); Sinclair & Long 5651 (E); 5665 (E); Darjeeling: Clarke 26416 (BM, W); Craib 628 (K); Gamble 260 (K); 4010 (K); 9987 (K); Hara & Togashi 1646 (TI); Sikkim: Clarke 9774 (BM); Hara s.n (TI); Hooker s.n. (AMES, BM, E, K, W); Kurz s.n. (BM); Pantling 26A (BM, W); 26B (BM, K); 26C (E); Treutler 949 (K).

Pachystoma pubescens: Bhutan: Kanai, Murata, Ohashi, Tanaka & Yamazaki 14292 (K, TI); Ludlow & Sherriff 3010 (BM); Ludlow, Sherriff & Hicks 18574 (BM); Terai: Clarke 27017 (BM, K, W); Haines 351 (K); J.J. Wood 148 (K); Duars: Haines 604 (K); Pantling 432 (BM, E, K, W).

Panisea demissa: Bhutan: Grierson & Long 3704 (E); Kanai, Murata, Ohashi, Tanaka & Yamazaki 9170 (TI); Darjeeling: Clarke 36060 (K); Sikkim: King 187 (BM); 3077 (BM); Pantling 301A (BM, K, W); 301B (E, NBG); Sikkim/Chumbi: Clarke 10049 (K).
P. tricallosa: Bhutan: Ludlow & Sherriff 1050 (BM).
P. uniflora: Bhutan: Gurung s.n (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 2025 (TI); Sikkim: Hooker 42 (K-LINDL); 124 (K-LINDL, K); s.n. (W); Pantling 71A (BM, K, W); 71B (BM, K, W).

Pantlingia paradoxa: Sikkim: Pantling 420 (AMES, K, L, W).

Paphiopedilum fairrieanum: Bhutan: cult. Fairrie (K).
P. spicerianum: spec. n.v
P. venustum: Darjeeling: Hara s.n. (K, TI); Sikkim: Clarke 46420 (K); Dungboo s.n. (K); Hooker 314 (K); Pantling 253A (BM, K); 253B (W).

Papilionanthe greenii: Bhutan: H.F. Green s.n. (CAL?) n. v
P. teres: Darjeeling: Gamble 9431 (K); Sikkim: Pantling 45A (E); 45B (BM, K, W); 45C (K);
P. uniflora: Bhutan: Grierson & Long 4207 (E); Kanai, Murata, Ohashi, Tanaka & Yamazaki 5072 (TI); 7111 (TI); Darjeeling: Gamble 10485 (K); Pantling 350 (BM, K, W); Sikkim: Hooker 210B (K-LINDL); s.n. (K).
P. vandarum: Bhutan: Kanai, Murata, Ohashi, Tanaka & Yamazaki 11213 (TI); Sikkim: Hooker 210A (K-LINDL).

Peristilus affinis: Sikkim: Pantling 453 (BM, K).

P. constrictus: Darjeeling: Kurzweil 130 (NBG); Pantling 447A (K); 447B (BM, W); Treutler 435 (K); Sikkim Hooker s.n. (K)

P. elizabethae: Bhutan: Miehe 00-255-03 (MB); 00-278-04 (MB); 00-279-07 (MB); 00-283-05 (MB); 00-286-03 (MB) 00-340-07 (MB); 00-349-39 (MB); Sargent 115 (E); Wood 5647A (E); 6487 (E); 6490 (E); Darjeeling: Kanai, Ohashi, Hara, Iwatsuki & Ohba s.n (TI); Chumbi: Dungboo s.n (K); Hobson s.n. (K); Spencer Chapman 349 (K); 817 (K).

P. fallax: Bhutan: Bowes Lyon 15140 (BM); Grierson & Long 2514 (E); 2762 (E, THIM); Gurung 20 (Herb. D.B. Gurung); Miehe 00-278-03 (MB); 00-351-01 (MB); Sinclair & Long 5093 (E); Wood 5563 (E); 6488 (E); Sikkim: Clarke 46415 (K); Hooker 288 (K-LINDL); s.n. (K); Pantling 174 (BM, K); 426 (BM, E, K); Chumbi: Hobson s.n. (K); Spencer Chapman 289 (K); 367 (K).

P. goodyeroides: Bhutan: Cooper 2412 (E); 3286 (BM, E); Griffith 28 (K-LINDL); 5305 (E, K); Ludlow, Sherriff & Hicks 20923 (BM, E); Miehe 00-202-14 (MB); Wood 7090 (E, THIM); Darjeeling: Anderson 1207 (BM); Kanai, Murata & Togashi 1659 (TI); Kurzweil 129 (K). Sikkim: Cave s.n. (E); Hooker 309 (K-LINDL); Pantling 231A (BM); 231B (K).

P. hamiltonianus: Darjeeling: Griffith 5356 (K).

P. lacertiferus: Darjeeling: Pantling 345 (BM, K).

P. nematocaulon: Bhutan: Bowes Lyon 13075 (E); Gould 1064 (K); Gurung 19 (Herb. D.B. Gurung); Wood 7109 (E); Darjeeling: Kanai, Ohashi, Hara, Owatsuki & Ohba 726200 (TI); 726199 (TI); 726213 (TI); s.n. (TI); Sikkim: Clarke 10029 (K); Hooker s.n. (K); Pantling 406A (BM, K); 406B (AMES, E, L, W); 406C (BM, K); 406D (BM, K, W).

P. parishii: Sikkim: Cave s.n. (E); Gammie s.n. (K); Pantling 156A (BM, K, W); 156B (BM, K).

P. prainii: Bhutan: Griffith 28 (K-LINDL); Darjeeling: Pantling 167 (BM, K).

P. pseudophrys: Sikkim: Pantling 424 (CAL, n.v.).

P. superanthus: Bhutan: Dungboo 242 (K); Sikkim: King 4446 (K); Pantling 341A (BM, K); 341B (BM, E, K).

P. tipuliferus: Darjeeling: Pantling 176B (W); Renz 10075 (BAS); Sikkim: Pantling 176A (E). 176C (BM, K); 176D (BM, K, W).

Phaius flavus: Bhutan: Bedi 1126 (K, THIM); Ludlow & Sherriff 2956 (BM); Ludlow, Sherriff & Hicks 18546 (BM); Terai: Brandis s.n. (K); Darjeeling: Hooker s.n. (K, W); Lacaita 15522 (BM); Pantling 207A (BM, K, W); 207B (BM, K); Sikkim: Hara s.n. (TI); Hooker 163 (K-LINDL); 164 (K-LINDL).

P. mishmensis: Bhutan: Bedi 1125 (K, THIM); Bowes Lyon 5198 (BM); Griffith 5281 (K); Gurung 81 (Herb. D.B. Gurung); Darjeeling: Bellett s.n. (K); Clarke 13486 (K); Sikkim: Gamble s.n. (K); Pantling 18 (BM, K, W).

P. nanus: Duars: Gamble 6672B (K); Haines 597 (K); Pantling 433 (BM, K, W); Darjeling: Gamble 6672A (K).

P. tankervilleae: Bhutan: Gurung 107 (Herb. D.B. Gurung); Kanai, Murata, Ohashi, Tanaka & Yamazaki 14973 (TI); Ludlow, Sherriff & Hicks 18870 (BM); Terai: Gamble 675 (K); 3976 (K); Sikkim: Clarke 46459 (K); Hooker s.n. (K); Lacaita 15524/15523 (BM); Pantling 120A (BM, K, W); 120B (BM); 139 (BM, K, W); Townend 116 (OXF).

Phalaenopsis braceana: Bhutan: Gamble's collectors, icon. Brace (CAL).

P. deliciosa subsp. **hookeriana**: Darjeeling: Hara & Kurosawa s.n. (TI); Sikkim: Pantling 94A (BM, K, W); 94B (BM, K).

P. lobbii: Darjeeling: Mann s.n. (W); Sikkim: Pantling 74A (BM, K); 74B (BM, W).

P. mannii: Bhutan: Grierson & Long 3757 (E); Sikkim: Mann 10 (W); s.n. (W); Pantling 263 (BM, K, W).

P. taenialis: Bhutan: Dorji, Pearce & Cribb 4 (THIM); 27 (E, K, THIM); 43 (E, K, THIM); 70 (THIM); Griffith s.n. (K-LINDL); Kanai, Murata, Ohashi, Tanaka & Yamazaki 11128 (TI); 11198 (TI); 14886 (TI); Ludlow & Sherriff 242 (BM); 994 (BM); Murata, Ohashi & Yamazaki 10096 (TI); Darjeeling: Griffith 5231 (K); Togashi 1677 (TI); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1678 (TI); 1679 (TI); 1680 (K, TI); Pantling 82 (BM, K, W).

Pholidota articulata: Bhutan: Bowes Lyon 15118 (BM); Dorji, Pearce & Cribb 25 (THIM); Grierson & Long 1408 (E, K, THIM, TI); 2996 (E); 3461 (E); 4557 (E); 4677 (E); Sinclair & Long 5769 (E); Terai: Hooker s.n. (K); Darjeeling: Clarke 11810 (K, W); Gamble 10562 (K); 10583 (E, K); Griffith 5045 (K); Kurzweil 133 (NBG); Sikkim: Gammie s.n. (K); Hara, Kurosawa & Ohashi s.n.(TI); Hooker s.n. (K, W); Pantling 31A (BM, K); 31B (BM, K, W); 31C (NBG); 32 (BM, K, W).

P. imbricata: Bhutan: Grierson & Long 3538 (E); 3578 (E); 3629 (E); Terai: Cave s.n. (E); Sikkim: Hooker s.n. (BM, OXF, W); Pantling 30 p.p. (BM, E, K, W).

P. missionariorum: Bhutan: Kanai, Murata, Ohashi, Tanaka & Yamazaki s.n. (TI).

P. pallida: Bhutan: Dorji, Pearce & Cribb 38 (THIM); Grierson & Long 1550 (E, K, THIM); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 13653 (TI); 14504 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 11301 (TI); 13783 (TI); 14103 (TI); Ludlow, Sherriff & Hicks 18873 (BM, E); Miehe 00-050-01 (MB); Darjeeling: Cowan s.n. (E, K); Gamble 10353 (K); 10444 (K); Griffith 5048 (K); s.n. (W); Hooker s.n. (K); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 1645 (TI); Hooker s.n. (W); Hooker & Thomson 78 (K-LINDL); Pantling 30A p.p. (K); 30B (W).

P. protracta: Bhutan: Hara s.n. (TI); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 9005 (TI); s.n. (TI); Darjeeling: Gamble 9993 (K); Griffith 5042 (K); Sikkim: Clarke 25229 (K, W); Pantling 55A (BM, K, W); 55B (NBG).

P. recurva: Darjeeling: Gamble 9696 (K); Griffith 5032 (K); s.n. (K-LINDL); Sikkim: Hooker 158 (K-LINDL); King 2273 (BM); Pantling 93A (W); 93B (BM, K).

P. rubra: Darjeeling: Griffith 5043 (K); Pantling 58A (BM); Sikkim: Clarke 9722 (K); Hooker 123 (K-LINDL); s.n. (BM, K, OXF, W); Pantling 58B (K); 58C (W).

Phreatia elegans: Darjeeling: Pantling 295C (W); Sikkim: Pantling 295A (K); 295B (BM).

Platanthera arcuata: Bhutan: Bowes Lyon 3328 (BM); 15079 (BM); Gould 688 (K); 725 (K); Ludlow & Sherriff 3529 (BM); Ludlow, Sherriff & Hicks 19295 (BM); 20881 (BM).

P. bakeriana: Bhutan: Bowes Lyon 13069 (E); Sargent 47 (E); Darjeeling: Clarke 27411B (K); Sikkim: Clarke 10405 (K); 12550 (K); Gammie 1282 (K); Hooker s.n. (K); Pantling 401A (BM, W); 401B (K); 401C (K); 401D (BM, E, L, W); 401E (AMES, BM, W); Renz 10079 (BAS); Chumbi: King's collector 426 (K).

P. bhutanica: Bhutan: Cooper 2596 (BM, E); Sikkim: Gammie 625 p.p. (BM).

P. biermanniana: Sikkim: Pantling 332 (BM, E, K, W); Renz 10074 (BAS).

P. clavigera: Bhutan: Gurung 12 (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 16955 (BM, E); 19513 (BM, E); 21396 (BM, E); Rohmoo 1221 (E); Sargent 191 (E); Sinclair & Long 4845 (E); 5010 (E); Wood 5732 (E); 6491 (E); Darjeeling: Kanai, Ohashi, Hara, Iwatsuki & Ohba 722192 (TI); Hara s.n. (TI); Long, McBeath, Noltie & Watson 1106 (E); Sikkim: Clarke 25011 (K); 25761 (K); Hooker 273 (K); 275 (K-LINDL); s.n. (BM, K, OXF); s.n. (E); Pantling 413A (BM, K); 413B (BM, E, K); J. Pradhan s.n. (K); Chumbi: Dungboo s.n. (K); Hobson s.n. (K); Spencer Chapman 339 (K); 814 (K); 821 (K).

P. cumminsiana: Sikkim: Pantling 329 (K).

P. dyeriana: Sikkim: Pantling 407A (AMES, K, L, W); 407B (BM, E, K).

P. edgeworthii: Bhutan: Gurung 4 (Herb. D.B. Gurung); Sinclair & Long 5009 (E, K); Darjeeling: Hara, Kurosawa & Ohashi s.n. (TI); s.n. (TI); s.n. (TI); s.n. (TI); Kanai, Ohashi, Hara, Iwatsuki & Ohba 726179 (TI); Ohashi, Hara & Iatsuki 726178 (TI); Sikkim: Hooker 312 p.p. (K-LINDL); Younghusband s.n. (K); Chumbi: Hobson s.n. (K); Spencer Chapman 294 (K); 334 (K); 363 (K).

P. exelliana: Bhutan: Cooper 2479 (BM, E); Miehe 00-151-13 (MB); Wood 5568 (E); Sikkim: Gammie 625 (BM, K); s.n. (K); Hooker 311 (K-LINDL, K); s.n. (K); s.n. (AMES); King 4202 (K); 4398 (K); 4573 (K); s.n. (K); King's collector (BM); Long, McBeath, Noltie & Watson 303 (E); 452 (E); Lowndes 624 (E); Pantling 327 (BM); Rohmoo 843 (E); 956 (E).

P. latilabris: Bhutan: Ludlow, Sherriff & Hicks 20941 (E); Sargent 190 (E); Wood 6492 (E); Darjeeling: Drummond 21028 (K); Sikkim: Hooker 312 p.p. (K-LINDL); Long, McBeath, Noltie & Watson 833 (E); Pantling 331A (BM); 331B (E, K); 331C (BM, K).

P. leptocaulon: Bhutan: Grierson & Long 2751 (E, THIM); Ludlow, Sherriff & Hicks 16868 (BM); 19451 (BM, E); 20823 (BM, E); Miehe 00-286-05 (MB); Darjeeling: Gamble 10363 (K); Sikkim: Hooker 315 (K-LINDL, K); s.n. (BM); Long & Noltie 79 (E); Pantling 422A (BM, E, K); 422B (BM, K); Rohmoo 921 (E); 1170 (E); Chumbi: Hobson s.n. (K).

P. pachycaulon: Bhutan: Miehe 00-235-05 (MB); Sikkim: King's collector 4345 (K); Hooker s.n. (K); Pantling 328 (BM, K); Starling, Upward, Brickell & Mathew 278 (K); Tibetan collector s.n. (K).

P. sikkimensis: Darjeeling: Kanai, Ohashi, Hara, Iwatsuki & Ohba 726214 (TI); Sikkim: Dungboo s.n. (E); Gamble 10434 (K); Long, McBeath, Noltie & Watson 746 (E); Pantling 421A (BM, K); 421B (BM, E, K).

P. stenantha: Bhutan: Ludlow & Sherriff 896 (BM); Ludlow, Sherriff & Hicks 21056 (BM, E); Wood 7175 (E, THIM); Darjeeling: Clarke 27411A (K); 27578 (K); Kanai, Ohashi, Hara, Iwatsuki & Ohba 726176 (TI); Sikkim: Clarke 9993 (K); 25836 (K); 25954 (K); Hooker 316 (K); s.n. (K); King 2214 (K); 4452 (K); s.n. (K); Kirkpatrick 262 (E); Kurz s.n. (BM); Pantling 233A (BM, E, K); 233B (BM); Starling, Cunnington, Main, Haselgrove, Macpherson & Mason 351 (K); Thomson s.n. (E); Treutler s.n. (K); Chumbi: Gamble 3995A (K).

Pleione hookeriana: Bhutan: Bedi 140 (THIM); Bowes Lyon 3187 (BM); Cooper 3895 (BM, E); 3971 (BM, E); Gould 247 (K); 321 (K); 547 (E, K); Grierson & Long 319 (E, THIM); 1724 (E, K, THIM); Gurung 79 (Herb. D.B. Gurung); 84 (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 21858 (TI); 21859 (TI); s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 5585 (TI); Kanai, Murata & Yamazaki 610 (TI); Ludlow & Sherriff 59 (BM); 3119 (BM); Ludlow, Sherriff & Hicks 16113 (BM, E); 16362 (BM, E); 18934 (BM, E); 20650 (BM, E); Darjeeling: Anderson 1218 (W); Clarke 35048 (W); 35664 (K); 35682 (BM); Gamble 8221 (K); 10440 (K); Hara, Kanai, Murata, Togashi & Tuyama 694/1643 (TI); Lace s.n. (E); Rohmoo 808 (E); Townend 110 (OXF); Sikkim: Clarke 27766 (K, W); 46316 (K); Hara, Kanai, Murata, Togashi & Tuyama 736/1644 (TI); Hooker 74 (K-LINDL); s.n. (AMES, BM, K, W); King's collector s.n. (E, W); Pantling 313A (BM, E, K, W); 313B (BM, K, W); Starling, Upward, Brickell & Mathew (AGSES)13 (E, K); Thomson s.n. (E, W); Sikkim/Chumbi: Clarke 27843 (K, W); Chumbi: King's collector 608 (BM).

P. humilis: Bhutan: Griffith 818 (K-LINDL); Gurung 89 (Herb. D.B. Gurung); Hara s.n.(TI); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 673341 (TI); s.n. (TI); Darjeeling: Clarke 13867 (K); 27044 (K); Gamble 3650 (K); 10276 (K); Griffith 5389 (K); Pantling 64 (BM, K, W); Sikkim: Clarke 8963 (K); Lister 26 (K); Hooker 75 (K-LINDL); s.n. (K).

P. maculata: Bhutan: Hara s.n. (TI); Sinclair & Long 5780 (E, K); Darjeeling: Clarke 9612 (K, W); Pantling 21A (BM, K, W); Sikkim: Clarke 9582 (K); 25473 (K); Gamble 10577 (K); Pantling 21B (BM, E); 21C (NBG, W).

P. praecox: Bhutan: Bedi 1093 (K); Cooper 2301 (E); 3678 (BM, E); Dorji, Pearce & Cribb 32 (THIM); Gurung 24 (Herb. D.B. Gurung); 80 (Herb. D.B. Gurung); Kanai, Murata, Ohashi, Tanaka & Yamazaki s.n. (TI); Ludlow & Sherriff 1006 (BM); 1069 (BM); Ludlow, Sherriff & Hicks 21250 (BM, E); Ludlow, Sherriff & Taylor 7222 (BM); Rushforth 946 (E); 1003 (E); Darjeeling: Clarke 8871 (K); 27447 (W); 35987 (BM); Gamble 6999 (K); 7281 (K); 9829 (E, K); Griffith 5201 (K); s.n. (W); Townend 132 (OXF); Sikkim: Clarke 9651 (K); 9726 (K); Craib 636-99 (K); Hooker 73 (K-LINDL); s.n. (BM, E, K, OXF, W); King s.n. (W); King's collector 188 (BM); Pantling 96A (BM, K, W); 96B (BM, K, W); Treutler 747 (K).

Podochilus cultratus: Bhutan: Grierson & Long 3611 (E); Sikkim: Hooker 1 (K-LINDL, K); s.n. (W); Pantling 188A (BM, K, W); 188B (NBG).

P. khasianus: Bhutan: Grierson & Long 4109 (E); Sikkim: Pantling 187 (BM, K, W).

Pomatocalpa armigerum: Sikkim: Pantling 252 (BM, K, W).

P. bambusarum: Sikkim: Pantling 211 (AMES, BM, K, W).

P. bhutanicum: Bhutan: Balakrishnan 41993A (CAL).

P. spicatum: Bhutan: Cooper 3099 (BM); Sikkim: Pantling 135A (K); 135B (BM, K, W).

P. undulatum: Darjeeling: Clarke 13971 (K).

Porpax elwesii: Darjeeling: Pantling 249 (K, W).

P. fibuliformis: Darjeeling: Pantling 278B (K); Sikkim: Pantling 278A (K, W).

Pteroceras teres: Duars: Haines 2837 (K); Sikkim: Pantling 286 (BM, K, W).

Rhomboda lanceolata: Darjeeling: Pantling 346 (BM, K); Sikkim: Hooker & Thomson s.n. (K).

R. longifolia: Sikkim: Hooker 335 (K).

Rhynchostylis retusa: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Darjeeling: Anderson s.n. (BM); Clarke s.n. (K); Griffith 5210 (K); Darjeeling/Sikkim: Gamble 9430 (K); Sikkim: Hooker 184 (K-LINDL); s.n. (K); Lacaita s.n. (K); Pantling 442A (E); 442B (W); 442C (BM, K).

Risleya atropurpurea Bhutan Ludlow, Sherriff & Hicks 16558 (BM, E); Sikkim: Long, McBeath, Noltie & Watson 172 (E); Pantling 451A (E, K, W); 451B (BM, K, W)

Robiquetia spatulata: Bhutan: Grierson & Long 3603 (E); Sikkim: Pantling 169 (BM, W)
R. succisa: Bhutan: Lister 1 (K); Sikkim: Pantling 158A (K); 158B (BM, W); 158C (BM, K, W); 158D (NBG).

Saccolabiopsis pusilla: Bhutan: Grierson & Long 3843 (E); Sikkim: Pantling 112 (K, W).

Satyrium nepalense var. **nepalense**: Bhutan: Bedi 569 (K); Bowes Lyon 5075 (BM); Cooper 2019 (BM, E); 2250 (E), Gurung 26 (Herb D.B. Gurung); Ludlow & Sherriff 459 (BM); 929 (BM); Ludlow, Sherriff & Hicks 19528 (BM, E); 16986 (BM, E); 20965 (BM); 21405 (BM, E); Miehe 00-273-12 (MB); Sinclair & Long 4902 (E); Wood 5768 (E, THIM); Darjeeling: Anderson 1205 (W); Clarke 12561 (BM); Clarke 24993 (K); 25029 (W); Hooker s.n. (BM, E, K, OXF, W); Pantling 464A (W); 464B (BM, E, K, W); Pradhan s.n. (K); Chumbi. Sikkim Lepcha 49 (E).
S. nepalense var. **ciliatum**: Bhutan: Bedi 718 (K); Bigger 2972 (E); Cooper 2682 (BM, E); 2915 (E); Gould 1202 (K); 1383 (K); Grierson & Long 2776 (E); Griffith 17 (K-LINDL); Gurung 15 (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 21416 (BM, E); Ludlow, Sherriff & Taylor 6091 (E); Sargent 230 (E); Sinclair & Long 4768 (E); 5000 (E, K); Wood 5697 (E, THIM); Darjeeling: Gamble 3978A (K); Pantling 297 (BM, K, W); Treutler 582 (K); Sikkim: Cave 76 (E, K); Clarke 9566 (E); 10216 (E); Cooper 876 (BM, E); Gammie 933 (BM); Hooker 259 (K-LINDL); s.n. (K); Ludlow & Sherriff 10007 (BM, E); Pradhan, Norbu & Naku 211 (E); Starling, Cunnington, Main, Haselgrove, Macpherson & Mason 670 (K); Townend 151. (OXF); Chumbi: Cooper 213 (E); Gould 1438 (K); King's collector s.n. (E).

Schoenorchis gemmata: Bhutan: Griffith 5212 (K); Gurung s.n. (Herb. D.B. Gurung); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14602 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 14095 (TI); s.n. (K, TI); Darjeeling: Clarke 27087 (W); Gamble 9429 (K); Sikkim. Clarke 27692 (BM, W); 46437 (K); Hara, Kanai, Murata, Togashi & Tuyama 3279 (K, TI); 3280 (TI); Hooker 209 (K-LINDL); s n (BM, K, W); King's collector s.n. (BM); Pantling 126A (BM, K, W); 126B (BM, K); Treutler 1010 (K); Younghusband s.n. (K).

Smitinandia micrantha: Bhutan: Grierson & Long 3338B (E); Griffith 3 (K-LINDL); 5249 (K); s.n. (W); Terai: Subramanyam s.n (K); Darjeeling: Cowan s.n. (E); Sikkim: Hooker s.n. (K); Pantling 78A (BM, K); 78B (W).

Spathoglottis ixioides: Bhutan: Bowes Lyon 13191 (E); Cooper 4159 (BM, E); Gurung s.n. (Herb D.B. Gurung); Ludlow & Sherriff 326 (BM); 354 (BM); 3544 (BM); Ludlow, Sherriff & Hicks 16920 (BM, E); 19497 (BM, E); 20849 (BM, E); Noltie 32 (E); Sikkim: Cave 75 (E, K); Hooker 146 (K-LINDL); s.n. (BM, K, OXF, W); King s.n. (BM); Long, McBeath, Noltie & Watson 785 (E); Long & Noltie 267 (E); Lowndes s.n. (E); Pantling 405A (BM, E, K, W); 405B (BM, K, W).

Spiranthes sinensis: Bhutan: Bedi 665 (K, THIM); Bowes Lyon 9044 (E); Cooper 1488 (E); 2795 (E); 3068 (E); Gould 1397 (K); Grierson & Long 203 (E);1210 (E, THIM); 1339 (E, K); 2651 (E); 3951 (E); 3986 (E, K, THIM, TI); Griffith 19 (K, K-LINDL); Gurung 6 (Herb. D.B. Gurung); 93 (Herb. D.B. Gurung); Ludlow, Sherriff & Hicks 16224 (E); 19516 (BM, E); 20950 (E); Noltie 15 (E); Sargent 229 (E); Sinclair & Long 5029 (E, K, THIM); Wood 5447 (E); 5539 (THIM); 7388 (E); Darjeeling: Cave s.n. (E); s.n. (E); Clarke 26859 (K); 26915 (K); Gamble 3982A (K); s.n. (K); Treutler 632 (K); Wenger 524 (K); Sikkim: Cave s.n. (E); s.n. (E); Clarke 25095 (K); Hooker 327 (K, K-LINDL); s.n. (OXF); Long, McBeath, Noltie & Watson 867 (E); 978 (E); Pantling 107A (BM, K); 107B (BM, K).

Staurochilus ramosus: Sikkim: Hooker s.n. (K).

Stereochilus hirtus: Sikkim: Pantling 157A (BM, K, W); 157B (NBG).

Sunipia intermedia: Sikkim: Pantling 161A (BM, K); 161B (AMES, BM, E, K).
S. scariosa: Darjeeling: Gamble 10336 (K); Griffith 5179 (K); Pantling 474B (BM, K, W); Sikkim: Clarke 25226 (W); Hooker 39 (K-LINDL); s.n. (K, W); Pantling 474A (BM, K).

Taeniophyllum crepidiforme: Sikkim: Pantling 193 (CAL n.v.).
T. retrospiculatum: Bhutan: Grierson & Long 2279 (E); Gurung s.n. (E); Kanai, Murata, Ohashi, Tanaka & Yamazaki 13981 (TI); Darjeeling: Pantling 165 (BM, K, W).

Tainia latifolia subsp. **latifolia**: Sikkim: Pantling 106A (E); 106B (BM, K, W); 106C (BM, K, W).
T. minor: Darjeeling: Anderson 1187 (W); 1217 (W); Clarke 35517 (BM, K); Kurz s.n. (BM); Sikkim: Pantling 210A (BM, K, W); 210B (BM, K).

Thelasis longifolia: Darjeeling: Cowan s.n. (E); Sikkim: Pantling 223 (BM, K, W).
T. pygmaea: Darjeeling: Griffith 5782 (K); Sikkim: Pantling 235A (BM, W); 235B (BM, K, W); Treutler 631 (K).

Thrixspermum centipeda: Duars: Pantling 463 (BM, K).
T. pygmaeum: Bhutan: Gurung s.n. (Herb. D.B. Gurung); Kanai, Murata, Ohashi, Tanaka & Yamazaki 13987 (TI).

Thunia alba var. **alba**: Bhutan: Dorji, Pearce & Cribb 19 (E, THIM); Darjeeling: Cave s.n. (E); Clarke 35778 (BM); Cowan s.n. (E, K); Gamble 9754 (K); Sikkim: Anderson 1224 (W); Clarke 27908 (BM, W); 81 (BM, K, W); Treutler 585 (K).
T. alba var. **bracteata**: Bhutan: Grierson & Long 3489 (E); Sikkim: Pantling 171 (BM, K, W).

Tipularia josephi: Bhutan: Kanai, Murata, Ohashi, Tanaka & Yamazaki 12623 (TI); Sikkim: Hooker 351 (K-LINDL); s.n. (AMES, K); Pantling 340A (BM, K); 340B (BM, K, W); 340C (BM, K, W); 340D (W).

Trichotosia dasyphylla: Darjeeling: Griffith 5131 (K); Hooker 55 (K-LINDL, K, W); Sikkim: Kurz s.n. (K); Pantling 90A (BM, K, W); 90B (BM, E, NBG, W).

CHECKLIST OF SPECIMENS EXAMINED

T. pulvinata: Darjeeling: Gamble 10335 (K); Sikkim: Hooker s.n. (K); Pantling 287A (BM, K, W); 287B (NBG).

Tropidia angulosa: Bhutan: Gurung 40 (Herb. D.B. Gurung); Darjeeling: Clarke 13759 (K); Sikkim: Pantling 349A (K, W); 349B (BM, E, NBG).
T. curculigioides: Darjeeling: Gamble 7689 (K); Griffith s.n. (K-LINDL); Sikkim: Pantling 180 (BM, K, W).

Uncifera acuminata: Darjeeling: Gamble 10453 (K); Sikkim: Hooker s.n. (OXF).
U. lancifolia: Darjeeling: Pantling 152A (BM, K, L, W); 152B (BM, K).
U. obtusifolia: Bhutan: Lister 2 (K); Sikkim: Clarke 12331 (K); Pantling 234A (BM, K, W); 234B (K).

Vanda alpina: Bhutan: Dorji, Pearce & Cribb 53 (E, K, THIM); 61 (E, THIM); Sikkim: Anderson s.n. (BM); Gamble 9436 (K); Pantling 164A (BM, W).
V. bicolor: Bhutan: Griffith 546 (K-LINDL); 5243 (K); Ludlow & Sherriff 1119 (BM); Ludlow, Sherriff & Hicks 18603 (BM).
V. chlorosantha: Bhutan: Trudel 402 (AMES).
V. cristata: Bhutan: Dorji, Pearce & Cribb 64 (E, THIM); 101 (THIM); Edwards 10 (E); Griffith 5206 (K); s.n. (K-LINDL); Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14620 (TI); s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 7077 (TI); 7094 (TI); 11210 (TI); 11220 (TI); 11295 (TI); 11313 (TI); 14280 (TI); 14696 (TI); 14841 (TI); Darjeeling: Griffith 5258 (K); McBeath s.n. (E); Sikkim: Clarke 27901 (K, W); Pantling 118A (BM, K, W); 118B (BM, K, W).
V. griffithii: Bhutan: Dorji, Pearce & Cribb 14 (E, K, THIM); 83 (E, K, THIM); Grierson & Long 4099 (E); 4511 (E); Griffith 4 (K-LINDL); 5251 (K); 5252 (K, W); Gurung 94 (Herb. D.B. Gurung); Trudel 841 (AMES); Sikkim: Pantling 164B (K).
V. pumila: Darjeeling/Bhutan: Gammie s.n. (K); Sikkim: Pantling 73 (K, W).
V. testacea: Bhutan: Dorji, Pearce & Cribb 11 (E, THIM); Gurung 50 (Herb. D.B. Gurung); s.n. (Herb. D.B. Gurung); Sikkim: Pantling 270 (BM, K, W).

Vandopsis undulata: Bhutan: Dorji, Pearce & Cribb 24 (E, K, THIM); Kanai, Murata, Ohashi, Tanaka & Yamazaki 7091 (TI); 11124 (TI); 11209 (TI); 11212 (TI); 11224 (TI); s.n. (K, TI); Ludlow, Sherriff & Hicks 18803 (BM); 21099 (BM); Darjeeling: Brandis s.n. (K); Griffith 5247 (K); Hara & Togashi 3276 (TI); Subramanyam s.n. (K); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama s.n. (TI); Pantling 72A (BM, W); 72B (BM, E, K, W); 72C (K); Townend 115 (OXF).

Yoania prainii: Sikkim: Pantling 469 (BM, K, W).

Zeuxine affinis: Duars: Pantling 309 (BM, E, K, W).
Z. flava: Bhutan: Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14567 (TI); 14615 (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 13903 (K, TI); 13971 (TI); 14039 (TI); 14288 (TI); 14863 (TI); Ludlow, Sherriff & Hicks 20163 (BM, K); Darjeeling: Pantling 109 (BM, K); Sikkim: Hara, Kanai, Murata, Togashi & Tuyama 3218 (TI).
Z. glandulosa: Bhutan: Grierson & Long 3873 (E); Duars: Pantling 434 (CAL).
Z. goodyeroides: Bhutan: Griffith 5347 (K); Miehe 00-018-14 (MB); 00-108-19 (MB);; 00-086-18 (MB); Sinclair & Long 4747 (E); Darjeeling: Dalzell 555 (K); Gamble 9990 (K); Griffith 5346 (K); Pantling 189B (BM, K); Sikkim: Anderson 1243 (BM); Clarke 25263 (K); 25300 (K); Pantling 189A (BM, E, K); 189C (W); 189D (W).
Z. membranacea: Bhutan: Griffith 16 (K-LINDL, K); Terai: Gamble 335 (K); Darjeeling: Clarke 26556B (K).
Z. nervosa: Bhutan: Ludlow, Sherriff & Hicks 18507 (BM); Miehe 00-001-07 (MB); Terai: Hooker s.n. (K); Duars: Pantling 307A (BM, E, K, W); Sikkim: Hooker s.n. (BM, K, OXF, W); Pantling 307A (BM, K, W).
Z. pulchra: Sikkim: Pantling 412 (K).
Z. reflexa: Bhutan: Hara, Kanai, Murata, Ohashi, Tanaka & Yamazaki 14525 (TI); 14624 (K, TI); s.n. (TI); Kanai, Murata, Ohashi, Tanaka & Yamazaki 14049 (TI); s.n. (TI); Darjeeling: Pantling 361 (BM, K).
Z. strateumatica: Duars: Haines 438 (K); Pantling 438A (BM, W); Sikkim: Hooker s.n. (AMES); Hooker & Thomson 352 (K, K-LINDL).

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